Mine Infrastructure and Economic Development in North Australia

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Working Paper No. 36

MINE INFRASTRUCTURE AND ECONOMIC DEVELOPMENT IN NORTH AUSTRALIA

by

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Working Paper No. 36
September 1986

Canadian Cataloguing in Publication Data

O'Faircheallaigh, Ciaran.
Mine infrastructure and economic development in North Australia

(Working paper ; no. 36)
ISBN 0-88757-076-3

1. Mineral industries - Australia. 2. Infrastructure (Economics). 3. Investment of public funds - Australia. I. Queen's University (Kingston, Ontario). Centre for Resource Studies. II. Title. III. Series: Working paper (Queen's University (Kingston, Ontario). Centre for Resource Studies); no. 36.

HD9506.A83N66 1986 338.2'09429 C86-094630-4

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PREFACE

This paper represents research supported by the Centre for Resource Studies aimed at improving the understanding of the conditions and issues facing the Canadian mineral industry, in order to assist in formulating policy decisions in industry and government. While the cases presented here are Australian, many of the conclusions apply equally in the Canadian context.

The Centre's working papers are offered for information and discussion, in an attempt to encourage feedback to the authors and additional research in mineral policy. Opinions presented are those of the author, and do not necessarily represent the views of the Centre or its sponsors.

Margot J. Wojciechowski
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FOREWORD

This study deals with the link between provision of infrastructure for mining projects and establishment of more broadly-based economic development in North Australia. The research on which it is based was funded by the Centre for Resource Studies, Queen's University, Kingston, Ontario, and by the Australian National University, Canberra. I would like to express my thanks to those institutions, and to the many mining company and government officials who provided information and access to mine sites. Deborah Wade-Marshall assisted in collating census material and preparing maps, while Elaine Sommer, Janet Sincock and Donna Beaubien helped with typing.

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SUMMARY

During recent decades Australia has become one of the world's leading mineral exporters; many of the mines developed during this period are located in remote areas lacking basic industrial and social infrastructure. Both federal and state governments played, and continue to play, an important role in providing the infrastructure required for mining operations, and they have invested very substantial amounts of public funds in the process. Use of public funds in support of privately-owned projects in remote areas has largely been justified in terms of the broader economic and social benefits expected to accrue from provision of mine infrastructure, through its use in industrial and agricultural activity or in other mining projects which could not themselves bear the full cost of infrastructure, or by existing communities which lack adequate access to services. It is argued below that this is indeed the only significant economic justification for such use of public funds.

However, there has been no systematic attempt by Australian governments or by academic researchers to establish empirically whether mine infrastructure in remote areas has in fact contributed significantly to more broadly-based economic and social development. A major purpose of this volume is to provide some relevant empirical evidence through case studies of four mining projects in North Australia, three of which have now been in existence for over 20 years. Use of specific infrastructure items is reviewed and the employment structure of resource towns/regions is analyzed, to establish whether mine infrastructure has been utilized more broadly and whether significant non-mining economic activity has developed. While the case studies are confined to one geographical area, the information they yield should be relevant to other situations in which governments undertake substantial investment for remote mining projects.

The case study evidence indicates that industrial infrastructure developed for particular mining projects (e.g. railways, ports, airports, industrial power and water supplies) has generally not been used in other mining operations or for non-mining economic activity. Use of social infrastructure (housing, schools, hospitals, domestic water and power supplies, township facilities) varied considerably, being substantial in two of the case studies and insignificant in the other two. This variation is explained by the nonmineral resource endowment of surrounding regions, proximity of the projects to existing communities lacking adequate access to social services, government policy in a range of areas (e.g. allocation of land, provision of public housing, industrial development strategy), and mining company policy on labour recruitment, town administration, and access to company housing.

These findings indicate that, in general, governments should refrain from investing public funds in industrial infrastructure for remote mining projects, and that investment decisions regarding provision of social infrastructure should take into account the non-mineral resource endowment of surrounding regions, the proximity of existing, under-serviced communities, and the policies adopted by project developers on relevant issues. Decisions to proceed with public provision of social infrastructure should be accompanied by appropriate policy initiatives in a range of related areas if the returns to society from its investments are to be maximized.

RESUME

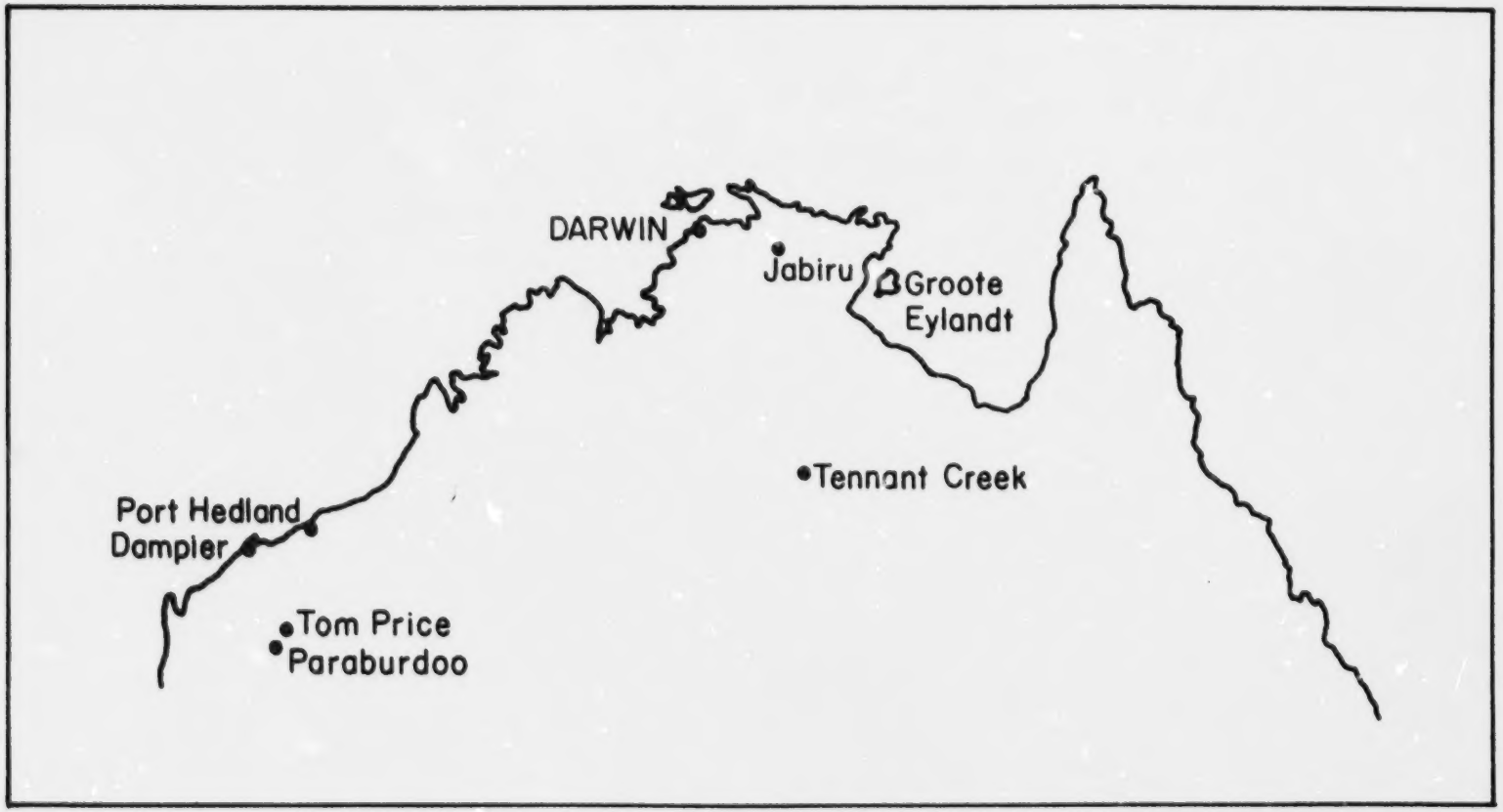
Au cours des dernières décennies l'Australie est devenue l'un des premiers pays exportateurs de minéraux du monde; de nombreuses mines mises en valeur pendant cette période sont situées dans des régions éloignées depourvues de l'infrastructure industrielle et sociale de base. Le gouvernement fédéral et ceux des états ont tous joué et continuent de jouer un rôle important dans la création de l'infrastructure requise pour l'exploitation minière et ils y ont investi des sommes assez considérables de fonds publics. L'utilisation de fonds public pour soutenir des projets du secteur privé dans des régions éloignées a été justifiée en grande partie par le fait que l'on s'attendait à une augmentation des profits sociaux et économiques dans un sens plus général, grâce à l'installation de cette infrastructure minière, qui devait servir à l'industrie et à l'agriculture ou à d'autres projets miniers ne pouvant supporter seuls tous les frais d'infrastructure, ou à des communautés existantes dépourvues de services adéquats. On cherche à démontrer cidessous qu'il s'agit bien là de la seule justification économique significative d'une telle utilisation de fonds publics.

Ni le gouvernement australien ni les chercheurs universitaires n'ont cependant fait de tentatives systématiques pour démontrer empiriquement qu'une infrastructure minière dans des régions éloignées a vraiment contribué de facon significative à un développement social et économique plus général. Un des objectifs principaux de ce volume est de fournir quelques preuves empiriques pertinentes au moyen d'études de cas de quatre projets miniers dans le nord de l'Australie, dont trois existent depuis plus de 20 ans. On examine l'utilisation d'articles spécifiques d'infrastructure et on analyse la structure de l'emploi dans les villes/régions possédant les ressources pour déterminer si l'infrastructure minière a servi de facon plus générale, et s'il s'en est suivi des activités économiques non minières importantes. Bien que les études de cas soient limitées à une seule région géographique, l'information qu'elles donnent devrait s'appliquer à d'autres situations où les gouvernements entreprennent d'investir des sommes assez substantielles dans des projets miniers éloignés.

Les études de cas montrent que l'infrastructure minière mise sur pied pour des projets miniers spécifiques (p. ex. voies ferrées, ports, aéroports, approvisionnement d'eau et de courant industriel) n'a en général servi ni à d'autres exploitations minières ni à des activités économiques non minières. L'utilisation de l'infrastructure sociale (logements, écoles, hôpitaux, approvisionnement d'eau et de courant résidentiel, édifices communautaires) variait beaucoup: elle était considérable dans deux des cas

étudiés et insignificante dans les deux autres. Cette variation s'explique par la richesse en ressources non minérales des régions environnantes, par la proximité de communautés existantes dépourvues de services sociaux adéquats, par la politique gouvernementale dans toute une série de domaines (p. ex. attribution des terres, construction de logements à loyers modérés, stratégie de développement industriel) et par la politique de la compagnie minière en matière de recrutement de la main d'oeuvre, d'administration municipale, et de logements fournis par le compagnie.

Ces constatations indiquent qu'en général les gouvernements devraient s'abstenir d'investir des fonds public dans une infrastructure industrielle pour des projets miniers éloignés, et que les décisions d'investir dans une infrastructure sociale devraient tenir compte de la richesse en ressources non minérales des régions environnantes, de la proximité de communautés existantes dépourvues de services adéquats, et des politiques adoptées par les promoteurs des projets pour les questions pertinentes. Si la société veut tirer le maximum de profits de ces investissements, les décisions d'investir des fonds publics dans une infrastructure sociale devraient être accompagnées d'initiatives appropriées en ce qui concerne les politiques dans un certain nombre de projets connexes.



Map 1. Location Map, North Australia

1. INTRODUCTION

In the decades after the second world war, Australia, like Canada, substantially increased its output of a large range of minerals. For example, during the period 1960-81, Australia's production of iron ore increased from 4.4 million to 92 million tonnes, of bauxite from 8,000 to 28 million tonnes, of nickel ore from zero to 2 million tonnes, and of manganese ore from 67,000 to 1.7 million tonnes.[1] With some exceptions, most notably oil and gas extracted from Bass Strait off the Victorian coast, the projects involved were located in geographically-remote and climatically-extreme parts of the country, requiring provision of basic infrastructure. During the period 1967-77, for instance, mining companies established 24 new towns and 12 new ports, and constructed over 10,000 houses and 1,864 km of railway tracks.[2] Again, the parallel with Canadian experience is clear.[3]

Before proceeding further, the term "infrastructure" should be defined more precisely. It refers to facilities and services which must be available before minerals can be extracted, processed into a saleable product, and shipped to a market. A distinction is usually drawn between (i) "production" or "industrial" infrastructure, which involves provision of inputs used in mineral production activities and refers mainly to railways, ports, roads, power, and water, and (ii) "social" infrastructure, which involves provision of facilities and services to employees of the mining company and its suppliers, and to their families (e.g. housing, education, health services, recreational facilities, domestic power and water supplies). In physical terms, the distinction between the two categories is not always clear-cut; for example, roads may represent an essential input to mineral production, but they may also be used by members of the mining community, and the same applies to water and power supplies.

The establishment of mine infrastructure in remote areas of Australia and Canada raises a large number of policy issues ranging in focus, for example, from the psychological effects on individual mining town residents of living in isolated and climatically harsh areas to the role of remote resource regions in the international political economy. In economic terms, one of the most significant issues relates to the potential of mine infrastructure to foster more broadly-based economic development. Such development is sought by politicians and their electorates as a source of additional wealth-generating opportunities, but also in many cases because extensive, remote and unpopulated or underpopulated regions are seen as a threat to national security, inviting potentially-

aggressive neighbours to utilise resources left idle by their current "owners".[4] Individual mining operations are of course finite by nature, which significantly limits their potential contribution to long-term development, but infrastructure installed to develop one mineral deposit might subsequently be used to develop others and might render viable economic activities of a more permanent kind (agriculture, tourism, manufacturing) which are not themselves capable of bearing the cost of basic infrastructure. The question of whether it can do so has important implications for government policies towards payment for and control of mine infrastructure in remote areas. If this infrastructure will help promote more broadly-based economic development, there may be a strong case for government to help finance it, and to maintain a measure of control over its design and operation so as to ensure its suitability and availability for non-mining activity. If it will not, governments may wish to insist that full infrastructure costs be borne by the developer, and may allow the mining company to design and operate the facilities involved entirely in accordance with its own (commercial) criteria.

Despite the salience of this issue and its implications for public policy, few attempts have been made to establish empirically whether mine infrastructure does or can contribute to more broadly-based economic development in geographically-remote regions (see below, page 19). This study presents some relevant empirical evidence from North Australia, using case studies of projects and resource regions in Western Australia (WA) and the Northern Territory (NT). The approach is twofold - information is provided on the infrastructure constructed in association with particular projects and on the extent to which this is used for non-mining activity, and the employment structure of resource regions is examined to determine whether significant economic diversification has occurred in the wake of mineral development. The case studies are presented in chapters 3 to 6; chapter 2 attempts to provide a broader context for the empirical analysis by discussing some key features of the policy debate on provision of mine infrastructure in Australia, and by outlining the infrastructure policies adopted by governments in North Australia during recent decades.

While the study is restricted to North Australia, its findings will clearly be relevant to other resource regions which display similar characteristics, particularly remoteness from existing major centres of population and industry, a paucity of prior large-scale economic activity, and extreme climate.

NOTES

1. For detailed information on the growth of Australian mineral production, see Bureau of Mineral Resources, Australian Mineral Industry Annual Review (Canberra: Australian Government Publishing Service (AGPS), various years).

2. Mining Review, November-December 1977, p. 16.

3. See, for example, I. Wallace, The Transportation Impact of the Canadian Mining Industry (Kingston: Centre for Resource Studies, 1977), p. 6; Mining Association of Canada, Mining in Canada: Facts and Figures (Ottawa: Mining Association of Canada, various years).

4. See, for example, B. Davidson, The Northern Myth: Limits to Agricultural and Pastoral Development in North Australia (Melbourne: Melbourne University Press, 1972), pp. 1-3.

2. PROVISION OF MINE INFRASTRUCTURE IN NORTHERN AUSTRALIA: PRINCIPLES AND POLICIES

It may be useful to begin by attempting to clarify some general questions of principle relating to provision of mine infrastructure in remote areas.[1] There is wide, though not complete, agreement among economists in Australia regarding what constitutes an appropriate general approach to the funding of such infrastructure:

> If there are no elements of external benefit and joint utilization of infrastructure, there should be little scope for argument, in a capitalist economy, about who should pay. In such instances infrastructure is nothing more nor less than an input to production, to be financed by the owners of the enterprise.[2]

If the state provides infrastructure or services at subsidized prices there is a transfer of income from residents of the state to the project owners, and where owners are foreign there is a loss of national income.[3] In addition, public subsidization of mine infrastructure may result in investment decisions which represent an inefficient use of resources from society's point of view:

> If confronted with the full economic cost to the community of proceeding with their projects, including the cost of relevant infrastructure facilities, private decision-makers are more likely to select the most beneficial projects from the standpoint of the community as a whole. By contrast, if because of intervention by governments or for other reasons, those costs are not taken fully into account in investment decisions, the particular projects preferred may not be the most beneficial and may displace others of greater potential benefit to the community.[4]

Thus the appropriate policy is for the project developer to pay for all infrastructure costs if only one user is involved or, if multiple use of infrastructure is to occur, for the state to provide it and recover its operating costs and an appropriate (risk-adjusted) return on its investment through service charges.[5] In other words, no subsidies should be offered projects either through public investment in construction of infrastructure or through application of user charges which fail to recover full operating and capital costs.[6] Conversely, mineral developers should not be required to provide infrastructure in the project area which meets broader community needs but which is unrelated to their own operations.[7]

A number of arguments have been put forward to justify departures from these principles. The first, often made by industry spokesmen, is based on considerations of equity. They point out that in urban areas social infrastructure and facilities used by industrial concerns and their employees (e.g. roads, water, sewerage) are funded by government from general revenue sources and that mining companies and their employees, who like other taxpayers contribute to general revenue, are entitled to provision of similar facilities.[8] However this argument ignores a number of important points. Infrastructure provided in major urban centres is utilized by a large number of different industrial concerns and individuals; if one venture fails and its workforce is retrenched, utilization of the infrastructure will continue at a high level, allowing the full life of the facilities to be realized and society to fully amortize its investment. If public funds are invested in infrastructure for a remote mine which subsequently fails, there may be a drastic decline in its use and a consequent loss of public investment. In addition, the cost of providing particular services is often much higher in new and remote mine towns than in existing centres of population; companies invest in, and their employees move to, remote areas because they expect to earn higher incomes and it seems appropriate that they themselves, rather than society as a whole, should meet the extra costs involved in providing services.[9] Thus considerations of equity would at most require that government contribute an amount equal to the marginal cost of providing those services in existing population centres.[10]

It should be noted that these objections to the "equity" argument lose some of their force to the extent that mine infrastructure is utilized in other economic activities, since the risk of public loss due to mine closure and its subsequent non-utilization is consequently diminished. In addition, establishment of such activities can be expected to increase the local population and reduce per capita costs of service provision, lessening the additional government expenditure required to provide services available elsewhere.

Second, some industry spokesmen argue that infrastructure policy should take into account the fact that international metal markets are now very much more competitive, and real metal prices significantly lower, than was the case in the 1960s and early 1970s. They claim that this is not the result of a short-term price cycle, but reflects basic structural features of international metal markets, particularly long-term decline in demand due to substitution by synthetics and to lower minerals intensity in developed country industrial production, and a failure by producers, especially in less developed countries, to adjust output accordingly. These developments have in their view resulted in fundamentally different

circumstances than existed, for instance, when the first generation of iron ore mines were established in the Pilbara. Mining companies could then support the full cost of infrastructure, but they cannot do so any longer, particularly since many projects currently being developed overseas benefit substantially from public provision of "free" infrastructure.[11] In the words of one senior company official, "in the current world climate of fierce competition, and given the remoteness of most mineral deposits, private developers in most cases simply cannot carry the cost of providing total infrastructure and services ...".[12] If Australia wishes to remain competitive and continue to enjoy the economic benefits generated by mining, it must contribute to the cost of establishing new projects, particularly by way of assistance with infrastructure provision.[13]

Quite apart from the factual question of whether other mineral producing countries are actually subsidizing project infrastructure, a number of issues are raised by this argument. First, it appears to be logically inconsistent: while part of the blame for the industry's current plight is attributed to subsidization of production elsewhere, the proposed solution involves subsidization of production in Australia,[14] which presumably can only lead to a further deterioration in international metal markets.[15] Second, there is the general question of efficiency in allocating society's resources, discussed above. The fact that other societies allocate their resources inefficiently does not provide a justification for Australia to do the same. Support of export industries which cannot otherwise be competitive in international markets will in the longer term be a burden on Australian society and one which, once shouldered, may be very difficult to escape from. When a major resource project has been established and a large number of people employed, considerable political pressure may be exerted to avert its closure; this is evident, for example, from the experience of the Mt. Lyell copper mine in Tasmania. By 1975 this project was uncompetitive at prevailing world copper prices, but its threatened closure led to considerable pressure being placed on the state and federal governments, which agreed to meet the cash deficits of the company concerned, "due to unacceptable unemployment and regional problems which would arise from the mine closure ...".[16]

It should be noted that calls by mining industry spokesmen (and some state politicians) for a greater government role in infrastructure provision pre-date the recent adverse conditions in metal markets,[17] suggesting that to at least some extent these conditions are being used to rationalize what is basically a call for public subsidization of private economic activity. It is also important to note that many senior Australian mining personnel do not believe that public provision of infrastructure is required to render their industry internationally competitive.

They feel that, as long as general fiscal and economic policies do not unduly penalize the industry and as long as work practices and general wages policy permit increases in productivity similar to those being achieved elsewhere, Australian mines can bear the full cost of infrastructure and still compete successfully in international markets.[18] The perspective of individual managers is of course strongly influenced by the particular industry sector in which they operate, and by the infrastructure policies pursued by the state in which their mines are located. As regards the latter point, the willingness of the WA government, for example, to leave mining companies in control of industrial infrastructure they pay for, and the fact that it has not attempted to use that infrastructure to appropriate economic rents (see below), is likely to significantly increase the industry's willingness to shoulder infrastructure costs.

A third argument for public provision of infrastructure, touched on above, is that public investment may be justified where a project would not otherwise proceed and is expected to generate substantial benefits for the regional or national economies. In other words, it may not offer a private investor the prospect of an adequate return on capital if he meets the full cost of infrastructure; however, public funding of some infrastructure may render the project commercially viable and be justified by the broader economic benefits it is expected to generate. This may be so particularly where governments have an avowed commitment to decentralisation of economic activity and development of remote areas.

This argument also has a major weakness. Empirical studies suggest that the "direct" economic impact of large-scale mining projects in remote areas of Australia are slight: they tend to be highly capital-intensive and so generate little employment, creating relatively little demand for goods and services compared to other economic activities, while the very high cost of establishing mineral processing facilities in remote areas usually means that their output leaves those areas in raw form. Their major economic contribution tends to occur via government taxation of economic rents.[19] However, projects which are expected to be sub-marginal without public provision of infrastructure are very unlikely to generate significant rents. Thus public support for their establishment is unlikely to be justified by economic benefits associated with the projects themselves, but rather by any contribution they make to the maintenance, establishment or expansion of other economic activities. The most obvious way in which this can occur is if mine infrastructure is utilized by such activities.

A fourth possible justification relates to the issue of foreign ownership and control of Australia's mineral resources. It has frequently been argued that the necessity to provide all major infrastructure items

very substantially raises the total capital costs of mining projects in Australia and so makes it impossible for Australian companies, particularly smaller ones, to raise the necessary capital alone. Only major foreign mining companies have access to funds on the scale required, and as a result Australian firms are forced to sell deposits they discover to foreign interests or involve such interests as co-venturers, leading to high levels of foreign ownership and control in the minerals sector.[20]

This argument raises a number of issues. First, it assumes that public provision of mine infrastructure would in itself remove the necessity for foreign involvement, which in turn assumes that inadequate access to capital is the only reason why Australian companies seek foreign involvement in developing mineral deposits. This second assumption does not seem warranted. In many cases, Australian companies have also lacked access to relevant technology and to export markets, and foreign investors have played an important role in providing both.[21] In such cases, public provision of infrastructure would presumably provide subsidies to foreign investors while leaving levels of foreign ownership unchanged. Second, even if it is assumed that inadequate access to capital by domestic mining companies does lead to higher levels of foreign ownership, it is not self-evident that public provision of infrastructure is the most efficient way of overcoming this problem; for example, removal of distortions in domestic capital markets or of restrictions on foreign borrowing might have a similar effect without requiring expenditure of public funds. And even if public provision of infrastructure would in fact result in a higher level of domestic ownership and is the only method of achieving such an outcome, there is still the question of whether the benefits of greater domestic ownership and control would outweigh the cost of infrastructure subsidies.

Though it is rarely put forward as an argument for departures from the "user-pays" principle, a significant reason for such departures is rivalry between individual states for investment in major projects.[22] Given limited availability of capital and of market outlets, states may find themselves competing for mineral investment; one way in which authorities can encourage investment in their states is to offer public assistance with infrastructure provision. Such an approach may be justifiable in state political terms, but as noted above is likely to result in development of projects which are less beneficial from the perspective of Australian society as a whole.

Thus it is apparent that departures from the "user pays" principle in regard to provision of mine infrastructure in remote areas must be justified largely in terms of any external economies associated with that infrastructure. So far, such economies have been discussed only as they

relate to commercial activities, but external benefits could also arise where facilities and services provided for a mining company's own use and that of its employees are available free of charge, or at less than their full cost, to existing residents of the mine region. This could only occur, of course, where significant indigenous populations existed and lacked access to the facilities and services concerned. If it does occur on a substantial scale, it is clearly of considerable significance in the present context, since one reason for promoting broadly-based economic development is, presumably, to improve the access of residents of the region concerned to transport, communication, health, education, housing and other services. However in the absence of such development, improvements in access to services which result from establishment of mining projects, may of course, be temporary.

This discussion raises two questions. First, have there in practice been departures from the "user-pays" principle in North Australia? Second, have external economies associated with mine infrastructure been sufficient to justify any such departures? The first question is addressed in the next section, which reviews infrastructure policies pursued by governments in North Australia during recent decades.

Infrastructure Policies in North Australia

Infrastructure policies in Australia have, of course, been formulated within the context of a federal political system. Constitutionally, mining is a state responsibility and the Commonwealth government consequently has little direct, formal role in the provision of mine infrastructure, except in Federal territories. In practice, Canberra has not been without influence in this area, because of its control over income tax measures applied to mining projects, its increasing dominance over most major fields of taxation and so over state finances, and its influence over state government borrowing. The latter is exercised through the Loan Council, established in 1927 to decide the total amount of borrowing by state governments, the terms and conditions on which loans were to be raised, and their apportionment among the various states.[23] However, the major features of policy have been laid down by state governments. As might be expected, the six states and the Northern Territory have not always adopted identical policies, and policies within each state have been modified in response to changing circumstances. In the present context our principal interest lies with Western Australia and the Northern Territory (the latter administered by the Commonwealth until 1978); the situation in Queensland, the third "northern" state, is also outlined.

Western Australia: There is a widely accepted view in the academic literature that infrastructure policy in Western Australia (WA) has undergone a significant shift during the last decade.[24] In the 1960s and early 1970s, it is argued, WA insisted that mining companies pay for all items of infrastructure, industrial and social. So, for example, the development agreements governing the establishment of iron ore mines in the Pilbara in the early and mid 1960s required the companies to pay not only for housing, retail and recreational facilities, water supplies, roads and sewerage in addition to more narrowly industrial items such as railways, ports, and power grids, but also for schools, police stations, health clinics and hospitals.[25] In general, industrial infrastructure such as railways and power stations were subsequently owned, controlled and operated by the mining companies, whereas facilities required for provision of public services (e.g. schools, police stations) were built or paid for by the companies and then handed over to the state government. The onus to pay for all infrastructure was imposed on the companies, it is claimed, because the state government lacked the financial resources to provide them itself and because of its conviction that these projects were sufficiently profitable to bear the costs involved and that the companies concerned had sufficient access to capital markets to raise all the funds required.[26]

More recently, however, the state government's access to capital, and particularly to loan finance, has been enhanced. Of particular significance in this regard were changes to the Loan Council's guidelines in June 1978 which provided for special additional borrowings by state authorities to finance infrastructure, subject to Commonwealth approval.[27] The states, including WA, made extensive use of this facility, borrowing $2,244 million during the period 1978-84. In 1980 the Commonwealth decided that the program was contributing to a blow-out in the Public Sector Borrowing Requirement, and it used its veto to make sure that no new projects were admitted to the program.[28] However, the states seem to have subsequently circumvented Commonwealth restrictions by using a variety of non-conventional fund-raising mechanisms which do not require Loan Council approval.[29]

While the access of state governments to funds for infrastructure development was improving, the capacity of mining companies to provide infrastructure was, it is claimed,[30] declining because:

i The much more competitive character of international mineral markets was cutting their profit margins.

ii The tax treatment of infrastructure expenditures was considerably less generous than it had been in the 1960s and early 1970s, due mainly to changes introduced by the Labor government in 1973 (see below for details).

iii Their access to capital markets had been adversely affected by domestic equity requirements applied by successive governments to new mining projects since 1973.[31]

It is argued that these developments have led the WA government (and other state governments), anxious to see major resource projects go ahead, to adopt a much more active role in infrastructure provision, a role advocated for some time by the former premier of WA, Sir Charles Court. He stated in 1976, for example: "More and more, we are finding that projects which could make the grade on their industrial investment are very marginal with infrastructure thrown on top. I think it is time Government began to recognize that this is a community responsibility - just as much in remote areas as in the city."[32] In 1980 in discussing the Northwest Shelf natural gas project he argued that WA would "need money for a massive infrastructure programme - on a scale that does not seem to be comprehended at all at this stage".[33]

It is important not to overemphasize the extent of change in policy between the earlier and more recent periods. Jan Brown has shown that, while mining companies did bear the full cost of infrastructure for inland mining towns in the Pilbara, the state government made substantial investments in ports and coastal towns used for shipping ore and for housing mining company and service industry employees, and in upgrading the regional road system to the standard required to efficiently service mining and related activities.[34] Outside the Pilbara, the state government was at times closely involved in providing infrastructure, including power and railways, particularly where prospects existed for further processing of minerals; for example, it assisted Western Mining Corporation in developing nickel mines and processing facilities by undertaking and helping to finance upgrading of existing railway track and construction of a 300 mile railway spur and by shipping its products at concessional rates.[35]

Officially, the WA government's position is that there has been a consistent policy that companies establishing resource projects in remote areas must fund and usually construct the required industrial and social infrastructure or, where facilities already exists, contribute towards any expansion made necessary by their presence. However, the state government has and will make some exceptions to this rule in certain circumstances.[36] In practice, such "circumstances" usually arise when the gov-

ernment believes that a project may not be viable unless it receives infrastructure subsidies. In other words, it assesses projects on a case-by-case basis; those which are expected to be viable while bearing the full cost of infrastructure are left to do so, while in other cases the extent of public subsidy is determined by the level of assistance believed to be required to ensure that a project proceeds.[37] Such an approach is of course compatible with growing public investment in infrastructure if the government perceives that resource projects in general are becoming less attractive to potential investors.

While there has thus been continuity in stated government policies, and more continuity than is often recognized in the policies actually implemented, it is nevertheless the case that WA government investment in mineral-related infrastructure has increased substantially over recent years. During the period 1978-81, it sought in excess of $1 billion in special infrastructure borrowings from the Loan Council, $170 million of which was approved for fiscal years 1980/1 and 1981/2, to finance, for example, pipelines and other facilities for Northwest Shelf gas, power integration in the Pilbara, provision of rail and water facilities for the Worsley alumina plant, and expansion of electricity capacity to service alumina refineries. More specifically, the infrastructure arrangements for the North West Gas development, for instance, are in strong contrast to those for the earlier iron ore projects. The state government has undertaken:

- to provide school, hospital and police facilities (though it might require the developer to lend it the funds required);
- to pay some of the cost of providing roads, and community, recreation, civic, social and commercial facilities for the project workforce;
- to supply, through the State Energy Commission, power to the project, and in doing so to make maximum possible use of special borrowings available through the Loan Council;
- through the relevant public authority to make water available to the project and its workforce and to upgrade airport and other facilities, with maximum use of special borrowings in both cases.[38]

It should also be noted that the transfer of company towns in the Pilbara to local government administration during the early 1980s (see below) has apparently resulted in increased public expenditure on maintenance of social infrastructure and provision of community services.[39]

Thus while their stated policies have consistently required that mining companies meet the full cost of infrastructure in remote areas, state

governments in WA have throughout assisted with provision of such infrastructure, and the extent of their commitment has increased substantially during recent years.

Northern Territory: The NT was administered by the Commonwealth until 1978 when it achieved self-government, and infrastructure policy was determined in Canberra prior to that date. The Commonwealth government believed it was necessary to encourage mineral development actively in the NT, "by providing assistance with the infrastructure necessary for development ... mainly by way of aid with transport and port facilities". In fact, it became heavily involved in the provision of infrastructure for all the major mines developed during the 1960s and early 1970s, in some cases providing industrial as well as social infrastructure. So, for example, in the mid 1960s it invested in excess of $10 million in upgrading sections of the North Australian railway and constructing stockpile, loading and wharf facilities in Darwin to permit transport and shipping of iron ore from the Frances Creek mine, located 190 km south-east of the city. It spent $1.7 million in building a paved road from the Mount Bundey iron ore mine to a railway siding, and subsidized rail freights and port handling charges for the two mines. It contributed $18 million of the $45 million which it cost to develop Nhulunbuy, the township established as part of NABALCO's bauxite/alumina project on the Gove Peninsula and provided, among other facilities, primary and secondary schools, a 64-bed hospital, government buildings and houses for government employees.[40]

The Commonwealth retained control of uranium mining and of National Parks after self-government which, combined with its crucial role in funding the NT government, has given it continued influence over infrastructure policy. This is particularly so as regards the Ranger project, a uranium mine located within Kakadu National Park and by far the most significant mineral development to occur since 1978. Under the Memorandum of Understanding which established the basis for financial relations between the NT and federal governments, the Commonwealth undertook to meet infrastructure costs incurred by the NT in relation to development of uranium mines. In the case of Jabiru, the Ranger mine town, these amounted to $21 million, and involved provision of single persons' quarters, houses, a transient camp for Aborigines, a hospital, health centre, police station, court house, fire station, and government offices, and a contribution towards the cost of land development and provision of basic services (roadworks, sewerage, water reticulation, industrial sites). In addition, the Commonwealth spent some $4 million directly on infrastructure provision.[41]

The Northern Territory government itself has issued no comprehensive statement regarding its infrastructure policies. The NT Department of Mines and Energy, which coordinates provision of mine infrastructure, has espoused a fairly strict application of the "user pays" principle:

> It is thus the view of the Northern Territory Department of Mines and Energy that mining projects, as well as other developments, should be liable for the full cost of the required infrastructure over and above that needed for independent community purposes.[42]

"Independent" in this case presumably refers to facilities required to meet community needs in the absence of mining activity. However, the Australian Council for Inter-Government Relations, on the basis of consultations with relevant authorities, described the NT's policy in somewhat different terms:

> Government involvement in infrastructure provision for new mining projects in the Territory is assessed on a case-by-case basis and determined by the location of the project, its relation to existing settlement, type of infrastructure etc. In general, however, government provides the normal community type infrastructure and services, whilst the developer provides infrastructure specifically needed for the development.[43]

It does appear that infrastructure policy will be determined, as suggested by the ACIR, on a case-by-case basis, and that in certain circumstances government will make a significant contribution. In the case of uranium mines, the NT government may of course have a strong incentive to provide infrastructure in order to encourage development, since the Commonwealth can be expected to bear the cost, or at least most of it, though the experience with Jabiru suggests that in practice the NT government may end up shouldering some of the financial burden. In that case, an NT government body, the Jabiru Town Development Authority (JTDA), borrowed funds from the Commonwealth to help pay for overdesign facilities in the town, installed on the assumption that its population would increase significantly when the Jabiluka and Koongarra uranium deposits were developed. It was assumed that the JTDA would charge new entrants for use of these facilities and thus raise sufficient revenue to repay its loans. However, the Commonwealth (Labor) government has halted development of these projects and they are unlikely to proceed in the near future; it is as yet uncertain to what extent the JTDA's loans will become an NT government liability. To date, the NT government has reportedly assisted with infrastructure for at least one other mine,[44] and it may do so again in the future. It should also be

noted that it is fully responsible for maintaining a range of services in mining towns once they are established, and that this involves it in substantial recurrent expenditure. For example, a recent study revealed that provision of services to Jabiru will absorb nearly the entire increase in NT government revenues arising both directly and indirectly from the Ranger project.[45]

Queensland: During the 1960s and early 1970s Queensland's governments, anxious to assist with establishment of mining projects in an attempt to foster and maintain strong growth in the state economy, did so in many cases by providing some of the required infrastructure. For instance, it provided a substantial proportion of the funds for upgrading the Mount Isa - Townsville railway in the early 1960s, paying for some of the work outright and obtaining Commonwealth loans to finance the remainder.[46] It spent $4.5 million on upgrading harbour facilities for the Weipa bauxite mine (which it intended to recover from wharf rentals and harbour dues), and during 1965-72 spent $4.3 million on township facilities at Weipa, including schools, a hospital, police station and employee housing.[47] In the early 1960s it also assisted in establishing coal mining in Central Queensland, helping to fund the Moura - Gladstone railway and providing generous housing assistance through the Queensland Housing Commission, while water supply and sewerage schemes were financed by local and state authorities.[48] It guaranteed repayment of loans worth $50 million raised to fund railway development for the Greenvale nickel mine during 1971-72,[49] provided $6.1 million worth of rolling stock, and built schools and accommodation for a section of the mine workforce.[50]

By the late 1960s it was becoming apparent that the Queensland mining industry was generally well-established, profitable, and in a strong competitive position internationally, and the government reviewed its infrastructure policy. Since 1969, it has insisted that mining companies bear the full cost of industrial infrastructure and tried to ensure that they contribute towards the cost of general public works (e.g. roads, water reticulation) and social infrastructure required for their projects.

The principal method for implementing this approach is the security deposit. Before a production licence is granted to a mining venture, the state Treasury provides an estimate of the investments considered necessary to meet the infrastructural demands of the project. These will include not only items specific to the mine itself (for example, a railway spur, specialized rolling stock, or extension of the electric power grid), but also any necessary upgrading of facilities already in use (for instance, main line railways, power generating stations, or regional road networks). The mining company is then required to deposit the relevant amount with the Treasury; the facilities are developed by, and sub-

sequently owned, controlled and operated by, public authorities such as Queensland Railways or the Harbours Board. The security deposit is repaid to the company over a number of years, from a unit capital charge which it pays for use of the facilities in question. The developer must also enter into negotiations with relevant state and local government authorities and agree on a contribution to any upgrading of urban infrastructure required as a result of a population influx into the mine region, e.g. sewerage, water, housing, community and recreational facilities.[51]

Queensland's approach has been formulated as an explicit and general requirement that the developer fund all infrastructure requirements attributable to its project, a policy implemented by the state's Co-ordinator General under provisions of the State Development and Public Works Organization Act 1981 which requires prior government approval for all infrastructure arrangements and lays down general guidelines regarding responsibility for its provision. The Act also allows the Co-ordinator General to declare major resource projects as "prescribed developments", which necessitates the preparation of an infrastructure coordination plan and the referral of land use applications to the Co-ordinator General. The plan identifies all infrastructure requirements together with costs and methods of apportioning their costs, and once approved by the Co-ordinator General, is binding on both public authorities and the developer. In this way, Queensland has attempted to minimize the demands made on the state's taxpayers as a result of resource-related infrastructure development.[52]

The state government does however retain some role in infrastructure provision. It provides health, welfare, education, police and community services, presumably on the grounds that these services would have to be provided to the people involved regardless of where they resided, and has participated in company housing schemes for mine workforces. It may also contribute to infrastructure which is expected, in the longer term, to facilitate a number of mineral developments but which, because of the timing of individual projects, cannot be funded by the prospective developers. In addition, it may accept greater responsibility where local processing of minerals is planned, or where scarce resources (e.g. deep water port sites, dam sites) are concerned and where government involvement is deemed essential to ensure that these are exploited as fully and efficiently as possible.[53]

It should be noted that Queensland utilizes its control over one item of infrastructure - railways - to impose what are in effect unit royalties, by charging freight rates which are well above the total cost of providing the relevant transport service. According to industry sources, revenues from this source are very substantial, and currently stand at between

$5.50 and $6.00 per tonne on coking coal from recently-developed mines.[54] One of the largest coal producers, Utah, has claimed that the tax element implicit in the rail freight charges it paid in 1981 was $53.9 million.[55] Neither WA or the NT have attempted to raise revenues in this way.

Commonwealth Policies: Apart from its direct role in the NT, the Commonwealth government has had a major impact on infrastructure funding through those sections of the Income Tax Assessment Act which deal with depreciation of infrastructure expenditures for tax purposes. Under provisions of Division 10 of the Act implemented in 1968 and prior years, mining companies were permitted to make infrastructure-related deductions for tax purposes which were more generous than those generally available. "Category A" concessions permitted deductions for items not allowable for other taxpayers: for example, preliminary site preparation and construction of housing and community facilities. "Category B" concessions allowed mining companies to apply generally-available allowances at an accelerated rate.

The cost of these deductions (in terms of revenue foregone by the Commonwealth Treasury) was substantial. No breakdown is available between deductions for infrastructure and for other items, but according to one estimate total loss of revenue due to Category "A" allowances amounted to $300 million during 1967/8 - 1972/3 while Category "B" allowances resulted in deferred tax liabilities of $445 million, with government's loss represented by the notional interest on this amount.[56] The Australian Mining Industry Council has estimated that nearly two-thirds of all investment in mineral development during the 1960s was absorbed by infrastructure costs,[57] which indicates that a substantial proportion of revenue foregone related to infrastructure expenditure. The figures quoted above refer, of course, only to the period 1967/8 to 1972/3. Total revenue foregone would have been considerably larger, and much of it would have related to the major iron ore, bauxite, nickel and manganese mines developed in North Australia.

The concessional element contained in Category A and B allowances were removed by the Labor government in 1973,[58] though some were subsequently restored by the Liberal/National Country Party Coalition after its return to office in late 1975. Prior to 1973, their existence led, in effect, to significant public investment in development of mine infrastructure in North Australia.

In recent years the Commonwealth has publicly espoused the view that "user pays" principles should generally apply to infrastructure funding.[59] However, it has been and is prepared to make exceptions, and to contribute to infrastructure costs where the projects involved are perceived to be of major importance to the national economy.[60]

This brief analysis illustrates the diversity of infrastructure policies applied in North Australia both over time and between jurisdictions. It indicates that:

i the WA, Commonwealth and Queensland governments have in the past invested very substantial sums in mine infrastructure, industrial as well as social;

ii during recent years Queensland, and to a lesser extent the NT, have moved to reduce the extent of public investment in mine infrastructure, but both still provide certain categories of infrastructure and may make additional contributions in particular circumstances;

iii the Commonwealth is committed to continued investment in infrastructure for uranium mines in the NT and is prepared to assist with infrastructure provision in certain other cases;

iv Western Australia has throughout adopted a project-by-project approach, but there are indications that it has recently moved towards greater public provision of mine infrastructure.

External Economies from Mine Infrastructure

Given the degree of public investment in mine infrastructure, it is clearly important to establish the extent to which it generates external economies. What information is available on this issue?

A substantial literature now exists regarding the development of mine infrastructure in remote regions of Australia. It focuses largely on the following areas:

i Demographic, sociological, psychological, architectural and town planning issues associated with mining towns in isolated areas.[61]

ii The question, discussed above, of whether infrastructure should be paid for and/or owned by private mining companies or by government.[62]

iii The computation of charges for use of government-funded infrastructure.[63] Of particular concern in recent years has been pricing of electric power supplied by government utilities to large-scale mining and mineral-processing concerns.[64]

v The use by state governments (particularly Queensland's) of infrastructure charges as de facto mineral taxes.[65]

Relatively little attention has been paid to the question of whether mine infrastructure in remote regions has generated external economies and so facilitated growth in other income-generating activities.[66] A number of academic writers have made passing and general references to the issue. Susan Bambrick, for example, has made the point that granting of tax concessions to assist mining companies in developing infrastructure may depend on the extent to which that infrastructure generates "external benefits", but provides no evidence regarding the likelihood of such benefits arising, other than by pointing out that the instability of mineral markets and the finite nature of mining activity militate against their emergence.[67] Newton and Sharpe state that the benefits of infrastructure in the Pilbara iron ore province appear to have been restricted to the mining towns themselves and to have had little impact on their hinterlands, but they produce no empirical evidence (e.g. longitudinal analysis of regional workforce structures) in support of their claim.[68] Stoeckel, on the other hand, argues that development of mine infrastructure in regions where agricultural activity already occurs will add directly to the welfare of farmers (presumably, for instance, by reducing their transport costs or improving their access to retail services), but provides no specific examples where this has occurred.[69] Forsyth also states that in certain cases other users will be able to take advantage of mine infrastructure, but the only example he cites relates to a study which forecast expected benefits from a rail link which had not yet been constructed.[70]

Politicians, senior bureaucrats and mining company officials have frequently commented on the issue during recent decades, usually arguing that mine infrastructure has contributed and will contribute significantly to more broadly-based economic development in remote regions. However, their claims have been made in general terms and usually without supporting examples or other empirical evidence.[71] Indeed, I have not been able to identify a single Australian study which attempts a detailed empirical assessment of the impact of mine infrastructure in specific cases.[72] Yet, as is evident from the earlier discussion, studies of this type would be highly relevant to the question of whether government or private enterprise should pay for, provide, and control mine infrastructure, and might also have a bearing on two of the other issues mentioned above: setting of infrastructure charges and use of such charges as an instrument for state taxation of mining ventures.

Thus little has been written on the issue of mine infrastructure and economic development in remote areas of Australia, and what has been written is lacking in empirical content. One must turn to the more general literature on the political economy of resource towns and regions to find any systematic analysis which is of relevance; though not dealing

specifically with mine infrastructure, a number of Australian and Canadian contributions to this literature do have important implications for the question of whether such infrastructure is likely to contribute to more broadly-based economic development. Of particular interest is the work of authors who use concepts similar to those employed in dependency and under-development theory to explain the growth and decline of resource towns and regions and the social and economic characteristics they display.

In the Canadian context John Bradbury, for example, has stressed the importance of the fact that, in the current phase of capitalism, the resource extraction sector and the towns associated with it are dominated by large, vertically-integrated capitalist firms which are multinational in the scope of their operations and in their approach to allocation of resources. Their aim is to maximize capital accumulation in their operations as a whole. Individual resource towns or regions are developed because, at a particular point in time, relative cost and other considerations render it advantageous for capitalist firms to do so. However, if circumstances change and the dictates of successful capital accumulation demand it, production will be switched to other regions or countries and the inhabitants of the original centres of production left to bear the burden.[73] Bradbury stresses that this may occur even where the physical resources on which production is based are not exhausted. And he argues that multinational corporations can readily abandon assets located at a particular production site, apparently because housing and plant are treated as part of the production sector (which presumably implies that they can be written off for accounting and tax purposes), and because part of the cost of social and physical infrastructure is borne by government and the mine workforce.[74]

Added to the unstable patterns of metal consumption and prices in major capitalist economies, this situation creates structural conditions which place resource communities in an extremely vulnerable position, highly dependent on a single economic activity which may cease at the dictate of an international corporate bureaucracy whose primary loyalty is to the firm rather than to any particular resource-producing region or country.[75]

In this scheme of things the role of the state, and of domestic political elites which control it, is a cooperative and supportive one, to "assist with accumulation and to legitimize the relations of production and the class relations within the private sector". It does this by encouraging inflows of capital and labour into resource regions, by providing infrastructure and an appropriate fiscal regime, and by implementing laws to legitimize work processes and class relations necessary for successful capital accumulation.[76]

The other major thrust of Bradbury's argument is that the relationship between resource regions and towns and the industrial centres they serve is essentially exploitative. Human, physical and capital resources flow from the former to the latter, underdeveloping the resource region, distorting its economy and leading to patterns of growth which are highly uneven in spacial, sectoral and temporal terms, while permitting accumulation of capital at, and enriching, the industrial centre. In addition, little impetus for more broadly-based economic growth is created by the resource sector itself, as the number of jobs provided is small and the commodities produced are of an unprocessed or semiprocessed nature, with the bulk of added value occuring in the industrial centre.[77]

Thus resource towns and regions are characterized by dependence on unstable and precarious economic activities and by an incapacity to diversify their economies so as to reduce this dependence; both of these characteristics reflect, in large measure, the dominance of resource production, and the successful co-option of local political elites, by internationally mobile corporations following the dictates of capitalist accumulation.

Peter Newton has taken up similar issues in analyzing the political economy of Australia's remote, mineral-producing regions. He also refers to the internationalization of capital in the mineral industry and the consequent absence of "place loyalty" to particular centres of production. He stresses the exploitative nature of relations between resource regions in Australia's North and the country's industrial centre arguing, for example, that there was a significant net outflow of capital to state and federal governments, restricting the potential for development within the resource regions.[78] Newton claims that the impetus for such development was unlikely to come from mining itself, given the large leakages of income and production linkages to metropolitan Australia and overseas.[79] He also argues that the distorted patterns of growth occurring in mineral regions were not due to any particular patterns of resource endowment, but to the activities of multinational corporations, operating in cooperation with local political elites tied to a (mistaken) belief in the feasibility of a mining-led progression to a "mature" industrial economy. In his words,

> The tendency for peripheral and semi-peripheral nations (and regions) to have only a limited number of (typically primary) products to export is not generally a reflection of endowment. Rather it arises as a result of transnational corporations obtaining the close cooperation of certain groups of people among business and government elites in the host countries of their subsidiaries.[80]

As mentioned above, Bradbury and Newton are not of course specifically concerned with the broader impact of mine infrastructure, but their analysis does strongly suggest that this impact will be minimal, not necessarily because of the nature of the infrastructure itself or of remote resource regions, but because of the broader institutional, economic and political framework within which minerals are exploited and mine infrastructure established.

Thus the existing literature includes claims or general arguments which support conflicting views regarding the extent of external economies from mine infrastructure and its potential to contribute to more broadly-based economic development, but provides very little detailed empirical information on which to assess the validity of these conflicting views. The case studies which follow will hopefully help to fill this gap.

NOTES

1. The provision of mine infrastructure adjacent to major urban centres or in densely-settled rural areas raises a somewhat different set of issues. For a discussion of these see, for example, J.P. McAuley, Planning and Financing of Resource and Infrastructure Development in New South Wales (Sydney: Planning Research Centre, University of Sydney, 1981); G.E. Littlewood, "Planning of Community Facilities for Resource Projects, Address to University of Queensland Minerals Industry Advisory Committee Seminar" (Melbourne: Mimeo, 15 July 1983); R.J. Clarke et al, The Aluminium Industry in Australia in the 1980s (Melbourne: Centre of Policy Studies, Monash University, 1981), pp. 109-18.

2. Clarke et al, The Aluminium Industry in Australia, p. 101. See also F. Perkins, The Financing of, and Charging for Resource Related Infrastructure (Canberra: Centre for Resource and Environmental Studies, Australian National University, Working Paper 1984/17, 1984), p. 14, 16; P.J. Lloyd, "How Do We Make a Resource Policy?", in Australian Institute of International Affairs, Resources in Australia's Foreign Relations (Canberra: n.d.), p. 21.

3. Lloyd, "How Do We Make a Resource Policy?", p. 22.

4. Commonwealth of Australia, Treasury Department, Resource development: maximizing opportunities (Canberra: AGPS, Treasury Economic Paper No. 8, 1981), p. 51. See also Perkins, Financing of Infrastructure, pp. 13-14.

5. F. Perkins provides a detailed discussion of the basis on which user charges for public infrastructure should be calculated: The Financing of Infrastructure, pp. 16-19.

6. For a dissenting view, see D.W. Barnett, "Is Infrastructure a Burden?", Australian Mining, November 1975, pp. 43-44. Barnett seems, however, to beg the fundamental issue involved in the debate on provision of mine infrastructure by assuming "that a dollar spent on (such) infrastructure provides the same benefits to the general community as a dollar spent on any other social project", and that infrastructure "is a social cost rather than an intrinsic cost of production" and that its provision by a mining company consequently represents payment to the government of "a discovery bonus exactly equal to ... infrastructure costs" (pp. 43-4).

7. Littlewood, "Planning of Community Facilities", pp. 4, 6; G.F.K. Santow, "Governmental Financing of Infrastructure - Legal, Political and Financial Restraints", Australian Mining and Petroleum Law Association Yearbook 1983, p. 93.

8. See, for example, Littlewood, "Planning of Community Facilities, pp. 5-6; R.E.S. Argyle, "The Ownership and Financing of Infrastructure Including Pipelines", Australian Mining and Petroleum Law Journal, vol. 2, no. 2, 1980, 206-7.

9. M. Folie has argued that mining represents a higher valued use of society's resources in Australia, and that government should consequently be prepared to meet the additional costs associated with provision of services in remote areas: "Finance, Pricing and Taxation Issues in the Export Coal Industry", in S. Harris and T. Ikuta, Australia, Japan and the Energy Coal Trade (Canberra: Australia-Japan Research Centre, 1982), p. 204. However, it could be claimed that one criterion for deciding whether mining can or cannot use resources more efficiently is its capacity to meet those additional costs itself.

10. For discussion of these and related issues, see Commonwealth of Australia, Treasury Department, Resource development: maximizing opportunities, pp. 51-52; Clarke et al, The Aluminium Industry in Australia, pp. 102-3.

11. Interviews with General Manager, Corporate Relations Services, CRA Services Ltd, Melbourne, 13 February 1985; with General Manager, Resource Project Development, Comalco Ltd, Melbourne, 13 February 1985; with Planning and Financial Analysis Manager, Mt. Newman Iron Ore Project, Melbourne, 14 February 1985. See also Santow, "Governmental Financing of Infrastructure", pp. 85-90, 111.

12. K.F. Parry, "Memo Canberra: The clock is ticking", Australian Mining, July 1985, p. 19.

13. Ibid., and sources quoted in note 11.

14. Clarke et al, The Aluminium Industry in Australia, p. 103.

15. This inconsistency was evident in interviews with some individual company officials who argued that they were opposed to subsidization of mining activity yet claimed that some public provision of infrastructure was essential if projects in which their companies were involved are to proceed.

16. Commonwealth of Australia, Industries Assistance Commission, Interim Report, Copper Ores and Concentrates (Canberra: AGPS, 1977), p. 3.

17. See, for example, R.H. Harding, "Financing Mineral Development", and C.W. Court, "The Role of Government", both in D. Douglas (ed.), Minerals Investment and Australian Development (Sydney: Dept. of Adult Education, University of Sydney, 1971).

18. Interview with General Manager, Marketing and Development, Hamersley Iron, Perth, 8 August 1985; with Manager, Resource Planning and Evaluation, Minerals Division, BHP Ltd, Melbourne, 14 February 1985.

19. C. O'Faircheallaigh, Mining and Development: Foreign Financed Mines in Australia, Ireland, Papua New Guinea and Zambia (London, Croom Helm Ltd, and New York: St. Martin's Press), Chapter Seven; The Impact of the Ranger Mine on the Northern Territory and Australian Economies (Darwin: North Australia Research Unit,

1986), Chapters One - Four; The Economic Impact of the Northern Territory Mining Industry: A Report to the Northern Land Council (Darwin: North Australia Research Unit, 1986). See also Advisory Council for Inter-Government Relations (ACIR), Intergovernmental Aspects of Major Resource Projects and Their Infrastructure (Hobart: ACIR, Discussion Paper 15), pp. 117-8.

20. See, for example, ACIR, Intergovernmental Aspects of Resource Projects, p. 114; Australian Resources Development Bank, "Submission to the Senate Committee on Foreign Ownership and Control", Official Hansard Report, 29 June 1972, p. 173.

21. See, for example, O'Faircheallaigh, Mining and Development, pp. 204-5; R.B. McKern, Multinational Enterprise and Natural Resources (Sydney: McGraw-Hill Book Co., 1976), chapter 9.

22. Commonwealth of Australia, Treasury Department, Resource development: maximizing opportunities, p. 49; Lloyd, "How Do We Make a Resource Policy?", p. 24; Perkins, The Financing of Infrastructure, pp. 13, 27, which also (pp. 19-21) provides details on the various methods used by state governments to provide subsidies.

23. For a discussion of state-federal financial relations as they relate to provision of mine infrastructure, see Perkins, The Financing of Infrastructure; ACIR, Intergovernmental Aspects of Resource Projects, chapter 6.

24. See, for example, S. Bambrick, Australian Minerals and Energy Policy (Canberra: Australian National University Press, 1979), pp. 148, 150; H. Thompson, "Normalization: Industrial Relations and community control in the Pilbara", Australian Quarterly, vol. 55, no. 5, spring 1981, pp. 304-5.

25. See, for instance, Iron Ore (Hamersley Range) Agreement Act, 1963-1964, Clause 9(b) (ii), 10, 11 (c); Iron Ore (Cleveland-Cliffs) Agreement Act 1964, Clause 8(b) (ii), 9(1), 10(c).

26. Argyle, "The Ownership and Financing of Infrastructure", p. 206; ACIR, Intergovernmental Aspects of Resource Projects, p. 122.

27. For a discussion of these changes, see Argyle, "The Ownership and Financing of Infrastructure", pp. 209-10; Santow, "Governmental Financing of Infrastructure", pp. 95-9.

28. Perkins, The Financing of Infrastructure, p. 9.

29. ACIR, Intergovernmental Aspects of Resource Projects, pp. 121, 124, Appendix E.

30. Santow, "Government Financing of Infrastructure" pp. 86-8; ACIR, Intergovernmental Aspects of Resource Projects, p. 122. Similar claims have been made by a variety of mining industry sources: see notes 11 and 12 above.

31. For details of the domestic equity guidelines applied to mining projects, see D.L. Anderson, Foreign Investment Control in the Mining Sector: Comparisons of Australian and Canadian Experience (Canberra: Centre for Resource and Environmental Studies, Australian National University, 1983), chapters 4 and 5.

32. Quoted in H. Thompson, "Normalization in the Pilbara", p. 305.

33. Quoted in B.W. Head, "The State as Entrepreneur: Myth and Reality", in E. Harman and B.W. Head, State, Capital and Resources (Nedlands: University of Western Australia Press, 1981), p. 38.

34. J. Brown, "Infrastructure Policies in the Pilbara", in Ibid., pp. 243-9.

35. Nickel Refinery (Western Mining Corporation Limited) Agreement Act 1968, Clause 9 (1), Nickel Refinery (Western Mining Corporation Limited) Agreement Act Amendment Act 1970, Clause 16.

36. Interview with Assistant Secretary, WA Department of Resource Development, Perth, 7 August 1985.

37. Within, of course, the limits of what is economically and politically feasible. See Perkins, The Financing of Infrastructure, p. 26; ACIR, Intergovernmental Aspects of Resource Projects, p. D18.

38. Brown, "Infrastructure Policies", Table 1, p. 241; North West Gas Development (Woodside) Agreement Act 1979, Clause 14, 15(2), 17, 18.

39. This has certainly been the case with Hamersley's towns in the West Pilbara: interview with West Pilbara Shire Clerk, Onslow, 14 August 1985.

40. Commonwealth of Australia, Department of the Interior, The Mineral Industry in the Northern Territory (Melbourne: n.d.), pp. 7, 14; Northern Territory Mineral Industry (Canberra: AGPS, 1973), pp. 6-8.

41. Information provided by the Jabiru Town Development Authority.

42. D. Woolfenden, "Mining", in Northern Territory University Planning Authority, Present Indicative and Future Conditional: A selection of papers on Northern Development (Darwin: NT University Planning Authority, n.d.), pp. 100-1.

43. ACIR, Intergovernmental Aspects of Resource Projects, p. D26.

44. The Enterprise gold mine near Pine Creek; personal communication from the Executive Director, NT Chamber of Mines, 4 February 1986.

45. O'Faircheallaigh, The Impact of the Ranger Mine, pp. 36-7.

46. Queensland Government Mining Journal, September/October 1959, p. 578, 20 November 1959.

47. Comalco Limited, "Submission to the Senate Committee on Foreign Ownership and Control", Official Hansard Report, 20 July 1972, p. 776.

48. S. Schubert, "A Central Queensland View", in Harris and Ikuta, Australia, Japan and the Energy Coal Trade, p. 253.

49. Freeport of Australia, "Submission to the Senate Committee", p. 792.

50. McKern, Multinational Enterprise and Natural Resources, p. 145.

51. ACIR, Intergovernmental Aspects of Major Resource Projects, pp. D15 - D17; Schubert, "A Central Queensland View", pp. 253-4.

52. ACIR, Intergovernment Aspects of Major Resource Projects, pp. D14 - D17; Perkins, The Financing of Infrastructure, pp. 23-5.

53. Perkins, The Financing of Infrastructure, 23-5; Schubert, "A Central Queensland View", pp. 254-5.

54. Interview with Manager, Resource Planning and Evaluation, Minerals Division, BHP Limited.

55. Lloyd, "How Do We Make a Resource Policy?", p. 24.

56. O'Faircheallaigh, Mining and Development, pp. 178-9, 185.

57. McKern, Multinational Enterprise and National Resources, p. 194.

58. For a detailed discussion of the Fitzgerald Report, which led to their removal, and of the issues it raised, see O'Faircheallaigh, Mining and Development, pp. 178-85.

59. Perkins, The Financing of Infrastructure, p. 22.

60. Interview with Assistant Secretary Commonwealth Department of Resources and Energy, Canberra, 12 February, 1985.

61. The literature on these issues is very large indeed. See, for example, T.B. Brealey and P.W. Newton, "Migration and new mining towns", in I.H. Burney, R.J. Prior, and D.T. Rowland (eds) Mobility and Community Change in Australia (St Lucia: University of Queensland Press, 1980); P.W. Burvill, "Mental Health in Isolated New Mining Towns in Australia", Australia and New Zealand Journal of Psychology, vol. 9, 1975, pp. 71-96; J. Lea and R.B. Zehner, The Planning of Resource-Based Communities in Australia: Identifying the Issues (Planning Research Centre, University of Sydney, Occasional Paper No. 12, 1983); P.W. Newton and R. Sharpe, "Regional Impacts of the Mining Industry in Northern and Western Australia", in C.A. Forster and R.J. Simpson (eds), Papers of the Fifth Meeting of the Australian and New Zealand Section (Tanunda: Regional Science Association, December 1980).

62. In addition to the literature already cited, see P.J. Forsyth, "Transport infrastructure and mining industry development", in P.J. Lloyd (ed.) Mineral Economics in Australia (Sydney: George Allen & Unwin, 1984), pp. 243-8. R.C. Jensen has attempted an unconventional approach to this issue by applying input-output analysis to the question of who should pay for mine infrastructure: "The Regional Significance of Large Development Projects", Paper to Japan-Australia Workshop, Nagoya, Japan, August 1983, pp. 14-23.

63. See, for example, Forsyth, "Transport Infrastructure", Commonwealth of Australia, Senate Standing Committee on National Resources, The Development of the Bauxite, Alumina and Aluminium Industries (Canberra: AGPS, 1981).

64. See, for instance, Commonwealth of Australia, The Development of the Bauxite, Alumina and Aluminium Industries, chapter 2; H. Dick, "Power Subsidies to Aluminium Smelters in NSW" (Newcastle: University of Newcastle Discussion Paper No. 18, 1981); G. Smith, "Energy Policy and the State Electricity Commission", in E.J. Harman and B.W. Head (eds) State, Capital and Resources, pp. 257-75. The findings of these and other relevant studies are summarized in Perkins, "The Financing of Infrastructure, p. 29.

65. See, for example, Forsyth, "Transport Infrastructure", pp. 243-4; J.H. Cassing and A.L. Hillman, "State-Federal Resource Tax Rivalry: The Queensland Railway and the Federal Export Tax", Economic Record, vol. 58, no. 162, September 1982.

66. Some attention has been given to external dis-economies associated with mine infrastructure, particularly adverse environmental impacts. See, e.g., Forsyth, "Transport Infrastructure", pp. 250-1; Clarke et al., The Aluminium Industry in the 1980s, pp. 105-6, 110-29.

67. S. Bambrick, The integration of Australia's mineral policies (Canberra: Faculty of Economics, Australian National University, 1972), pp. 5, 19.

68. Newton and Sharpe, "Regional Impacts of the Mining Industry", pp. 117-8.

69. A. Stoeckel, "The Perspective of the Rural Sector", in S. Harris and G. Taylor (eds.), Resource Development and the future of Australian Society (Canberra: Centre for Resource and Environmental Studies, Australian National University, 1982), p. 105.

70. Forsyth, "Transport Infrastructure", p. 238; the study involved is that referred to in note 72.

71. See, for instance, Australian Mining Industry Council, Progress - Mining and Environment (Parkville, Victoria: 1971), p. 3; P.V. Jones, "Defence Through Development", in Northern Australia Development Council, Australia's Northern Resources (n.p., 1982), p. 105; Court, "The Role of Government", p. 36; Freeport of Australia,

"Submission to the Senate Select Committee", pp. 789-93; H.G. Raggatt, Mountains of Ore, (Melbourne: Landsdowne Press, 1968), p. 75.

72. One study, by the Bureau of Transport Economics, does provide projections of transport cost savings expected to accrue to existing producers from railway construction associated with coal-mining: Commonwealth of Australia, Bureau of Transport Economics, Sandy Hollow-Maryvale Railway: Economic Evaluation of Proposed Completion (Canberra: AGPS, 1979).

73. J. Bradbury, "Towards an Alternative Theory of Resource-Based Town Development in Canada", Economic Geography, vol. 55, 1979, pp. 149-52, 155-7, 163.

74. Ibid., pp. 151, 155, 159.

75. Ibid., pp. 148-9.

76. Ibid., p. 151.

77. Ibid., pp. 148-9, 152, 161.

78. P.W. Newton, "In the North overseas priorities inhibit local identity, with ultimate economic and social costs", Royal Australian Planning Institute Journal, vol. 17, 1979, p. 190.

79. Ibid.; P.W. Newton, "The Problems and Prospects of Remote Mining Towns: National and Regional Issues", in Australian Institute of Urban Studies, Urban Australia: Living in the Next Decade (Canberra: 1984), 97, 99-100.

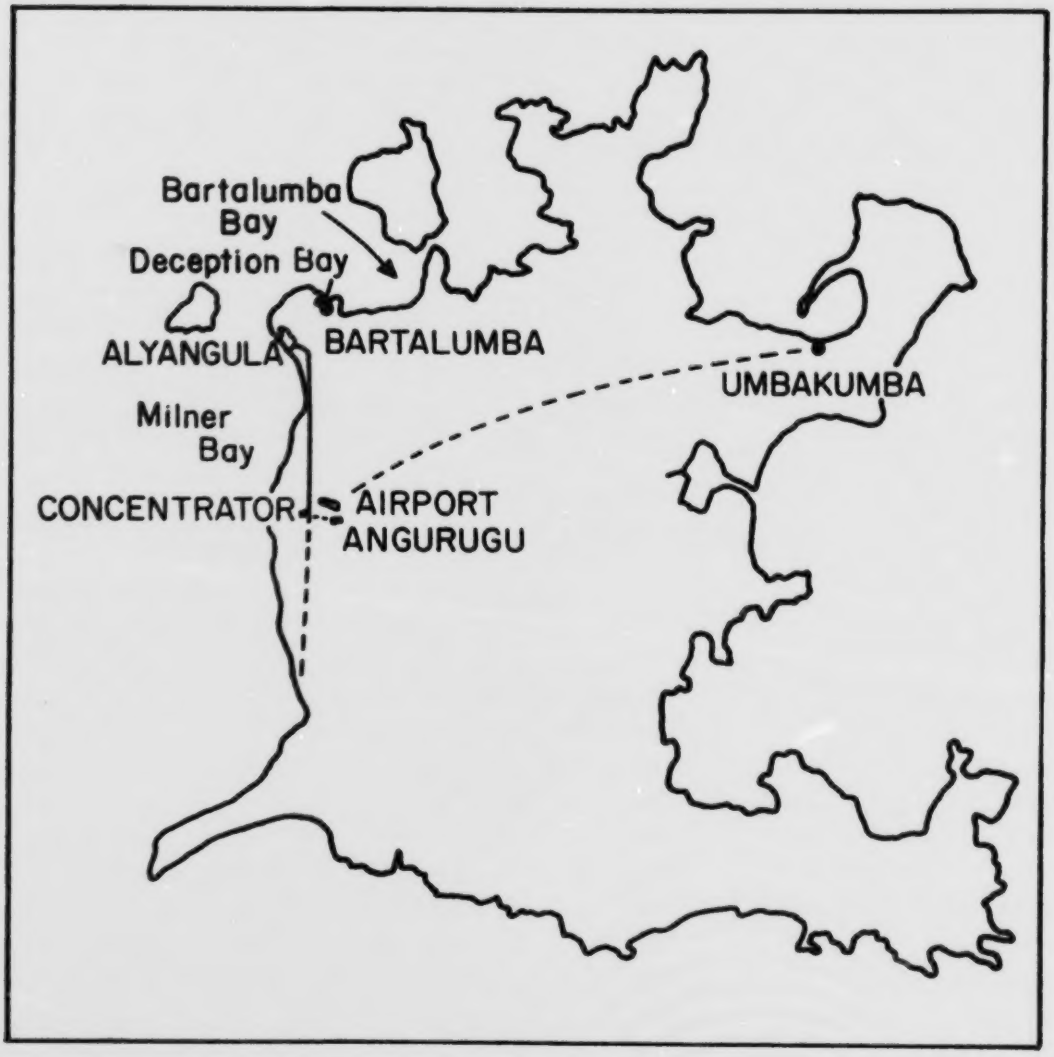
80. Newton, "The Problems and Prospects of Remote Mining Towns", p. 98.

3. MANGANESE MINING ON GROOTE EYLANDT

During the mid 1960s the Broken Hill Proprietary Co. Ltd. (BHP) established the existence of very extensive manganese deposits on Groote Eylandt, situated 640 km east of Darwin and 48 km off the coast of Arnhem Land in the western bight of the Gulf of Carpentaria (see location map, page 31). The Groote Eylandt Mining Company (GEMCO), a BHP subsidiary, commenced mining on a small scale in 1966 while exploration was still going on, and shipped about 100,000 tonnes of manganese products, mainly to BHP's steel plants, in that year. By 1969 substantial additional ore reserves were established and overseas markets secured, and production rose to nearly 750,000 tonnes. Construction of a concentrator during 1971-72 to treat lower grade ores led to a further increase in production (1.5 million tonnes in 1973), and expansion continued under the stimulus of buoyant overseas and domestic demand; output peaked at 2.2 million tonnes in 1976. Production fluctuated significantly during subsequent years in line with changing conditions in international manganese markets; in 1985 it stood at nearly 2 million tonnes. Estimates of current ore reserves vary, but they are certainly sufficient to maintain mining well into the future, economic conditions permitting. No other economically-significant mineral deposits have been discovered on Groote Eylandt.

Development of infrastructure, particularly social infrastructure, was gradual, reflecting the fact that the scale of operations changed considerably as time went on and as more information became available regarding reserves, technology and markets; it was only when it became clear that GEMCO could establish itself as a major producer of manganese in the long term that BHP and the Commonwealth were prepared to commit the resources required to develop a wide range of community facilities and services. A township and associated wharf and industrial facilities were established some 15 km from BHP's mining leases, at Milner Bay on the northwestern tip of the island. They were set up on Aboriginal land, through the granting in May 1965 of 99-year Special Purpose Leases under the NT Special Purpose Leases Ordinance 1953. The area provided reflected the current perception of the likely scale of operations; in the event, mining has been on a considerably larger scale than originally envisaged, but the Lease boundaries have not subsequently been extended, a fact which has severely limited the possibility of significantly expanding the township.

Because of its remote location and apparent paucity of commercially-exploitable natural resources, Groote Eylandt was one of the last parts of Australia's North to receive the attention of government and business.



Map 2. Groote Eylandt

Until the 1920s its Aboriginal inhabitants continued to live a traditional lifestyle, "nomads of the coastal bushlands, fishing, hunting and gathering different foods in different places as it was available".[1] By 1945, radical changes had occurred; nearly all the Aborigines had settled permanently at the Church Missionary Society (CMS) mission at Angurugu, on the west coast and close to where BHP would peg its mineral leases, and at the flying-boat refueling base at Umbakumbu on the east coast. The CMS was later to act strongly to ensure that Aboriginal interests were protected when mineral exploitation commenced. In particular, it took out prospecting licences over areas in which manganese was subsequently discovered, and negotiated an agreement with BHP under which the company agreed to pay local Aborigines an ad valorem royalty in return for access to these licence areas.[2] Mining has consequently generated substantial royalty income for the local Aboriginal communities, particularly Angurugu; this has mainly been used to make modest cash distributions to individual clan groups, to build up a capital fund, and to finance customary and cultural activities and development of outstations (i.e. small settlements away from the major communities in areas inhabited prior to the arrival of Europeans).

When BHP arrived in 1962, the island was still populated almost entirely by Aborigines; there was almost no commercial activity, and people depended for their livelihood on rations provided by Christian missions and on social security payments, supplemented by bush foods. Mining has provided employment opportunities for local people, particularly male residents of Angurugu, usually in unskilled and semi-skilled positions. A prawn processing plant was established at Bartalumba Bay (see map) in 1969 by Kailis Groote Eylandt Fisheries Ltd., and was subsequently taken over by a Japanese firm, Gollin Kyokuyo Fishing Co. The plant operated during the 1970s and employed up to 70 people, between 10 and 30 of them Aboriginal women from Angurugu, but by the late 1970s it was evident that it was uneconomic to process prawns on Groote Eylandt. Kailis resumed ownership of the Bartalumba Bay facilities, shifted its processing activities to Western Australia, and now employs only a handful of people on Groote to provide a basic repair and provisioning service for its prawn trawlers.[3]

Mine Infrastructure

The following sections provide details regarding the infrastructure installed and services provided as a result of GEMCO's operations, and regarding the extent to which these are utilized for non-mining activity;

where possible, information is also provided on the situation which existed prior to BHP's arrival.

Port and wharf facilities: Prior to the establishment of the mine, no facilities existed on Groote for direct unloading of ships; freight was off-loaded onto barges or rafts and ferried ashore. Shipping services were limited and infrequent, usually 3-monthly from Brisbane. GEMCO constructed a modern wharf at Milner Bay; this is primarily geared towards loading very large tonnages of manganese, but it can also handle general cargo and includes a small roll-on/roll-off facility. The frequency of shipping services increased as a result of GEMCO's operations; initially a 3-weekly service was established, and currently ships or barges call from Brisbane or Darwin on a weekly basis.

The wharf and port facilities are of course largely used by GEMCO to export ore and import fuel and other inputs for mining. However they have also been used to import goods required by Angurugu and, to a lesser extent, Umbakumba. In the six months preceding May 1973, for example, cargo handled totalled 696,764 tonnes; of this 690,391 tonnes or 99 percent consisted of manganese exports, 5776 tonnes or 0.8 percent of GEMCO's imports, and 567 tonnes or 0.2 percent of imports for Angurugu (496 tonnes) and Umbakumba (71 tonnes). In the six months to November 1980, ore exports accounted for 98.7 percent of total tonnage, GEMCO imports for 1.2 percent, and Angurugu for 0.1 percent.[4] Port facilities are also used by prawn trawlers for refueling and shelter; they would of course be able to use Milner Bay for shelter in any case, but the nearest fuel supply source is at Gove, considerably further away from the prawn fishing fields.

Thus while GEMCO's port and wharf facilities are largely used by the company itself, their existence has presumably created some external economies for local Aboriginal communities, especially Angurugu, by providing them with shipping services which are more frequent and, presumably, somewhat less expensive. No data was available on freight charges prior to BHP's arrival, but the fact that direct unloading is now possible and that very much larger volumes of incoming cargo are involved has presumably helped reduce, or lessen increases in, unit freight costs. There may also be some external benefits to operators of prawn trawlers which refuel at Milner Bay.

Roads: GEMCO constructed paved roads from Alyangula to its mining leases near Angurugu and in the vicinity of the township; it also built a number of unsealed roads to provide access to quarries, and assisted in making tracks to Aboriginal outstations by lending equipment and operators. The mine's existence apparently led the Commonwealth government to provide additional funds for road improvement, and it up-

graded the Angurugu/Umbakumba and a number of other roads.[5] Apart from GEMCO and its suppliers, the major beneficiary of these initiatives have been local Aboriginal people, whose mobility has been significantly increased. The significance of this greater mobility has largely been social and cultural, rather than economic; in particular, it has provided local people with better access to parts of the island which are of spiritual or cultural significance, and facilitated the establishment of outstations in those areas.[6] The existence of the road network also benefited Kailis, particularly by allowing it to tap the labour supply available at Angurugu, though this factor is no longer relevant now that processing of prawns has ceased.

Airport: GEMCO constructed a modern air strip near Angurugu and as a result the extent and frequency of air services increased dramatically. Local Aboriginal people now have access to scheduled jet services which are unavailable to other communities of similar size in the region; they make considerable use of these, and also of charter flights using smaller aircraft.[7] Again, use of air services is generally not geared towards economic activity (e.g. export of local produce, travel to take up employment elsewhere), but rather involves maintenance and extension of social contacts on the mainland and attendance at inter-community cultural and sporting functions.

Power and water: GEMCO generates electric power in an oil-fired station which supplies Angurugu (on a "cost recovery" basis) as well as the mine and township. Angurugu did not have access to a regular power supply prior to 1966, though it would certainly have acquired one since then if the experience of similar-sized Aboriginal communities elsewhere in the NT is a guide. In this case, any external benefit relates to the earlier arrival of the service in question and to the greater reliability and possible economies of scale associated with a major industrial power station.

GEMCO constructed a pumping station and treatment plant on the Angurugu river and a pipeline to carry water to the mine and township. However, Angurugu provides its own water supply[8] and as far as could be established only the company itself, its contractors and township residents utilize the supply installed by GEMCO.

Township Facilities: GEMCO's workforce was initially small (138 in November 1966), almost entirely male, and experienced extremely high turnover rates (196 percent on an annualized basis in the second half of 1966). During the early years of the project, substantial numbers of employees were housed in temporary accommodation including tents and mobile homes; permanent housing was in short supply, and continued to be so as the labour force expanded in line with rising production. The

workforce reached 372 in November 1972, 423 a year later, and 622 in November 1976, a level it maintained until end 1980. It declined subsequently and despite recent increases is still below the peak level; however, housing remains in short supply because married persons now account for a significantly higher proportion of the total workforce than previously.[9]

GEMCO initially built about 100 houses, with a further 100 houses, 24 flats, and a new 174-room single-person accommodation block being added by 1976; government provided housing for its employees (police, teachers, health personnel) as it was required. Those employed by GEMCO's contractors and suppliers generally utilize GEMCO accommodation, particularly the old single-person units, or mobile housing provided by their employers; local agents for private sector service companies (e.g. bank, airline) rent accommodation from GEMCO, while retail outlets are run by relatives of GEMCO staff who do not require separate accommodation. There is thus no open market in rental or other accommodation in Alyangula; access to housing is only available though employment with GEMCO, its contractors, or the government.

A medical centre was established in a company building in 1968, but it was 1978 before a government health clinic was built. A school had been opened in 1971. The township now also possesses a police station, a recreation club, community hall, various leisure and sporting facilities, videotape television, a supermarket (company owned and subsidized), and a small number of speciality retail outlets.

The township facilities are overwhelmingly used by employees of GEMCO and its contractors and by their families, though the small number of residents at Bartulumba Bay do also make use of them. Members of the Angurugu community make some use of certain facilities, but not of others. They have not, for example, taken advantage of the more extensive educational facilities available at Alyangula, only a handful having attended the school since its establishment.[10] Angurugu itself possesses a school, and retail and basic medical services. Some residents do travel to Alyandula to take advantage of medical and dental facilities which are apparently superior to those available in similar-sized Aboriginal communities on the mainland.[11] Aboriginal people also make use of the major social and recreational club, mainly to purchase alcohol, though some other members of their community regard this as a dis-economy associated with GEMCO's presence.

Employment Structure

As mentioned in the introduction, data was assembled on employment structure in the various resource regions under review to establish whether indications existed of significant economic diversification over time. Table 1 provides figures on employment by sector for Alyangula and for Groote Eylandt as a whole, drawn from 1981 Census data. It should be noted that employment in industry, construction, transport, and business and personal services was very heavily concentrated in Alyangula; almost all employment in the remainder of the island was accounted for by provision of retail and public services to the two Aboriginal communities.

Table 1 clearly illustrates the dominance of mining, which accounted for exactly two-thirds of total employment in Alyangula and 53 percent on Groote. (The equivalent figure for Australia as a whole was 1.4 percent.) Employment in construction was close to the Australian average (7.5 and 6.5 versus 6.3 percent), but that in all other industry sectors was well below it. Of particular note is the total absence of employment in agriculture (which includes forestry and fishing), and the figure for manufacturing (1.7 percent for Alyangula as against 17.7 percent for Australia). The figure of 1.7 percent, low as it is, probably over-estimates the extent of manufacturing activity. Much of it is accounted for by the "Metal Products, Machinery" subdivision, but I was unable to find any evidence of firms producing such items on Groote Eylandt; it seems likely that enterprises engaged in structural steel erection and welding were mistakenly allocated to the manufacturing, rather than the construction, sector.

The Census data does not accurately reflect the importance of mining to employment on Groote Eylandt. First, it under-estimates employment in GEMCO itself, which stood at 589 in June 1981, 52 more than the ABS figure for "Mining". This presumably reflects the presence of some GEMCO employees in the "Not classified, not stated" category, which accounts for 10 percent of the total, and the absence of others from the island on the census date. Second, the ABS data does not, of course, indicate the extent to which employment in other industry sectors is directly dependent on mining activity (see below).

More recent employment data is not available for Groote Eylandt as a whole but, as noted above, employment outside the retail and public services sectors is almost entirely concentrated in Alyangula, and the author carried out a survey of employment in the town in October 1985. This was based on GEMCO's employment records, a postal survey of all federal and state government departments and agencies, and interviews with com-

Table 1

EMPLOYMENT BY INDUSTRY, ALYANGULA AND GROOTE EYLANDT, JUNE 1981

Industry	Alyangula		Groote Eylandt	
	Persons	%	Persons	%
Agriculture etc.	0	0	0	0
Mining	507	66.6	533	53.2
Manufacturing				
Textiles, Clothing	2	0.3	2	0.2
Metal prods, Machinery	9	1.2	9	0.9
Other and undefined	2	0.3	2	0.2
Total	13	1.7	13	1.3
Electricity, Gas, Water	0	0	0	0
Construction	57	7.5	65	6.5
Wholesale, Retail Trade	24	3.2	44	4.4
Transport, Storage	8	1.1	9	0.9
Communication	0	0	0	0
Finance, Property, Business Services	10	1.3	10	1.0
Public Admin., Defence	7	0.9	72	7.2
Community Services				
Health	10	1.3	17	1.7
Education	24	3.2	65	6.5
Other and Undefined	5	0.7	44	4.4
Total	39	5.1	126	12.6
Recreation, Personal, Other Services	19	2.5	20	2.0
Not Classified and Not Stated	77	10.1	109	10.9
Grand Total	761	100.0	1,001	100.0

Source: ABS, "1981 Census, Small Area Summary Data".

mercial enterprises operating in or from the town. The information obtained is presented in table 2. This follows the conventions employed by the ABS in compiling census data; in particular, it uses the Australian Standard Industrial Classification, and regards as employed all those who worked for wages, salary or profit during the relevant period, regardless of the number of hours worked.[12]

The survey indicates a pattern of employment similar to that revealed by the 1981 Census data, with differences in the proportion of employment accounted for by individual sectors largely explained by the absence of a residual "not stated" category. No evidence of agricultural or manufacturing employment was found. Mining accounts directly for 72 percent of employment, but it should be stressed that other industry sectors are heavily dependent on GEMCO's operations for their continued survival. To gauge the extent of that dependence, the survey requested information on the proportion of each respondent's income derived from sales to GEMCO. In the construction sector, for example, which is the second largest source of employment, 52 of the 80 people involved work for enterprises which receive in excess of 90 percent of their income from sales to GEMCO, while the remaining enterprises receive in excess of 75 percent of their income from GEMCO. Virtually all employment in other sectors involves provision of retail, transport, business, social and personal services to GEMCO's employees and those of its suppliers.

Thus, nearly two decades after its establishment, Alyangula's employment structure is still entirely dominated by mining, directly or indirectly, and if GEMCO's operations ended, employment would virtually cease. At present, there is little indication that this might happen. GEMCO is an efficient producer by world standards, it has generated substantial profits for BHP even during periods of poor markets and depressed prices, and in addition it provides BHP with a captive source of manganese ore, an essential input for its steel plants. However, adverse economic conditions might lead to a substantial scaling down of operations. Some scaling down did occur during the period 1981-84, when depressed overseas and domestic markets resulted in declining ore production and a consequent fall in the workforce from 623 in December 1980 to a low of 450 in May 1983. The cutting back of GEMCO's activities had significant flow-on effects on employment in Alyangula. These were particularly severe in the construction sector, as plans for expansion were cancelled and major maintenance programs deferred. One firm's workforce fell from 34 to six, another's from 11 to four.[13] There was little effect on employment in the public sector, presumably because the level of staffing was required. However, a more severe scaling down of mining would very probably lead to some reduction in public sector employment.

Table 2

EMPLOYMENT BY INDUSTRY, ALYANGULA, OCTOBER 1985

Industry	Number	%
Agriculture	0	0
Mining	546	71.9
Manufacturing	0	0
Electricity, Gas, Water	0	0
Construction	80	10.3
Wholesale, Retail Trade	23	2.9
Transport, Storage	11	1.4
Communication	3	0.4
Finance, Property, Business Services	13	1.7
Public Administration, Community Services		
Health	10	1.3
Education	23	2.9
Police	12	1.5
Other	4	0.5
Total	49	6.3
Recreation, Personal, Other Services	40	5.1
Grand Total	765	100.0

Source: GEMCO employment records; information provided by GEMCO, government departments and commercial enterprises.

Analysis

The infrastructure developed in association with GEMCO's operations is largely used by the company itself and its suppliers and by their employees, though some external economies have accrued to local Aboriginal people. They have received better access to shipping services and this has probably reduced transport costs on imported goods, and they received a reliable power supply more quickly and possibly more cheaply than they otherwise would have done. They also have better access to air services and to road transport on Groote than would otherwise be the case, but in these areas the benefits are social and cultural rather than economic. Some Aboriginal people also have access to improved medical services as a result of Alyangula's existence. Better access to infrastructure and services has not resulted in Aboriginal people establishing additional income-generating activities.

In general, there is little indication that significant external benefits have accrued to commercial ventures not related to mining. The Kailis prawn venture did make some use of certain facilities, but their availability was not responsible for the venture being established. The processing plant was set up on Groote because, first of all, under the terms of the fishing licences granted by the Commonwealth government in 1968, the firms involved were compelled to establish on-shore processing facilities; and second, because Groote Eylandt is close to the major Northern Territory prawn fishery, and Kailis believed that locating a plant there would give them an edge over their competitors. In the event, of course, processing on Groote did not prove to be economic. Prawn fishing ventures may have benefited from some reductions in costs as a result of being able to obtain fuel from GEMCO.

Thus the mine infrastructure associated with the development of manganese mining on Groote Eylandt, in place for nearly two decades, has apparently not contributed to the establishment of more broadly-based economic development. This is evident from the fact that the economy of Groote Eylandt is still entirely dominated by GEMCO's mining operations and associated activities and by provision of public services to the two Aboriginal communities. There are a number of factors which would explain this lack of diversification.

i Groote Eylandt lacks the natural resources to support activities which might have utilized GEMCO's infrastructure, such as agriculture, tourism, or exploitation of other minerals.

ii Groote's remote location and small population mean that production costs are high and markets distant, militating against the establishment of raw material processing. BHP undertook a study to assess the feasibility of establishing a plant for producing manganese alloys on the island, but the results indicated that such a project would not be economically viable. Processing of the other major local resource, prawns, has also proved to be uneconomic.

iii Alyangula is a "closed" company town with no open market in housing or other accommodation, and its potential for expansion is severely restricted because of its location on Aboriginal land. Both factors militate against the establishment of small-scale retail, service and tourist activity. There is a shortage of suitable land on which to set up such industries and on which to build houses for owners and workers, while mine employees who might consider staying on and investing their savings in establishing a small business lack access to accommodation once they resign from GEMCO.

iv Until recently, a large proportion of GEMCO's workforce consisted of young, single males whose average stay on Groote was short. Such individuals did not create as substantial a demand for education, health, retail, and other services as would, for example, married workers with young children. Thus the possibility that provision of such services would lead to population growth and a widening of the economic base was reduced. The fact that housing and community facilities were developed on a piecemeal basis over an extended period of time may have deterred families from coming to, or remaining in, Alyangula.

NOTES

1. K. Cole, Aborigines and Mining on Groote Eylandt (Bendigo: Keith Cole Publications, 1981), p. 6.

2. For details see Ibid., pp. 19-21.

3. K. Cole, Groote Eylandt (Darwin: Nungalinya Publications, 1975), p. 63; information provided by Assistant Director, Fisheries Management and Extension, Northern Territory Fisheries Division.

4. GEMCO, "Groote Eylandt Operational Report" (unpublished internal company report, 6 monthly, various dates).

5. Interview with Town Clerk, Angurugu Community Council, Angurugu, 2 October 1985.

6. Ibid.; interview with GEMCO's Superintendent, Administration and Finance, Alyangula, 19 March 1985.

7. Interview with Town Clerk, Angurugu.

8. Ibid.

9. GEMCO, "Groote Eylandt Operational Report", various dates.

10. Interview with Town Clerk, Angurugu.

11. Ibid.

12. ABS, Census 81 - Industry (Canberra: Commonwealth Government Printer, 1982), p. 1-2.

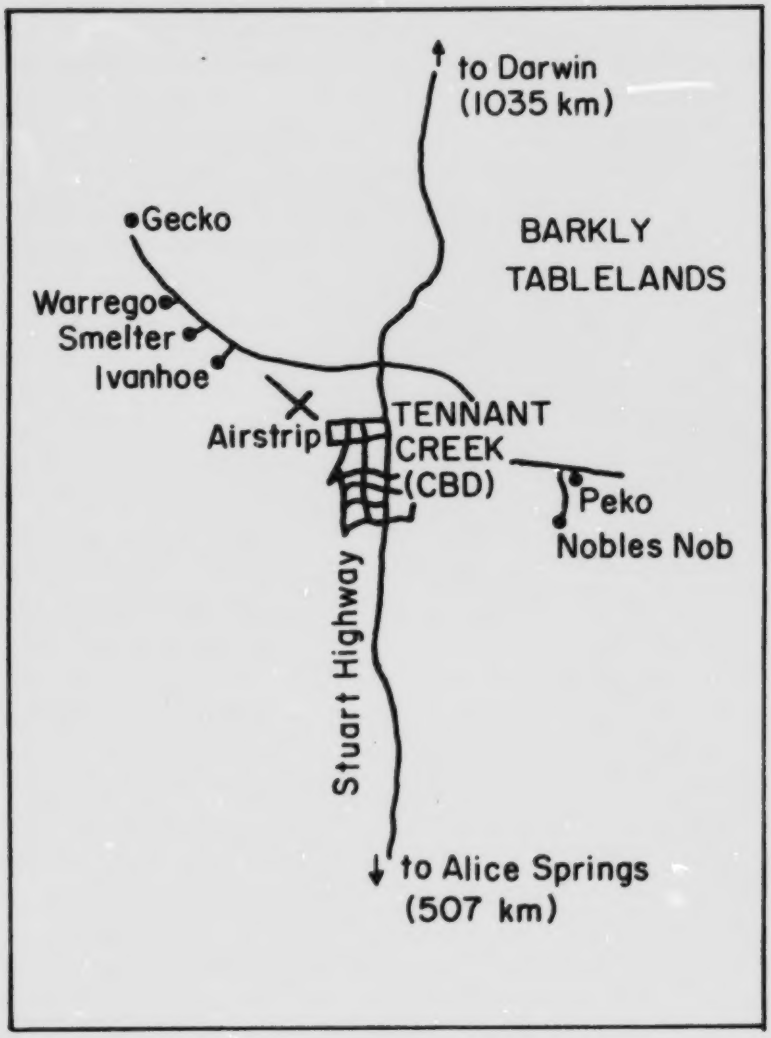
13. Author's Employment Survey.

4. PEKO MINES: GOLD AND COPPER MINING AT TENNANT CREEK

Tennant Creek is located on the Stuart Highway which links Adelaide and Darwin, 500 km north of Alice Springs and 1020 km south of Darwin (see map). The physical characteristics of the region are harsh, with average annual rainfall of 475 mm, virtually all of which falls between November and March, and maximum temperatures which exceed 30 degrees Centigrade on most days in the year. Introduction of water bores has allowed the establishment of a pastoral industry on the nearby Barkly Tablelands, but intensive agriculture has not been possible. Aborigines outnumbered Europeans in the area until the 1930s, and they still constitute a significant minority of the population.

Tennant Creek owes its existence to the discovery of wide-ranging though small and isolated gold deposits in 1933-34.[1] Initially, mining was on a limited scale, and involved individuals and small companies exploiting shallow, high-grade gold deposits. World War II interrupted production, but resulted in the construction of a paved highway to Alice Springs and Darwin. After 1945, exploitation of larger, deeper gold and copper/gold/bismuth deposits was undertaken, particularly by Australian Development Ltd. (ADL) at its Noble's Nob mine and by Peko Mines at a series of locations within a 40-km radius of Tennant Creek, the most significant being Peko and Warrego. Mining activity reached a peak in the late 1960s and early 1970s; extensive exploration was conducted, seven mines were in production or under development, and a copper smelter was constructed by Peko Mines. Exhaustion of reserves and poor copper prices subsequently led to a decline in mining activity and closure of the smelter; today, only one mine (Warrego) is in operation, though Noble's Nob continues to mill stockpiled material and is now developing recently-discovered ore reserves, while two small gold deposits are being brought on stream by Peko and another company.

Tennant Creek's population expanded rapidly to about 600 in the mid 1930s, and grew gradually over the following decades to reach 3118 to 1981. It was always an "open" town, and a range of facilities and services were developed as needs arose by private enterprise, government and voluntary organizations. A separate settlement was established at Warrego, some 35 km from Tennant Creek, when the mine there was developed, but the two communities are treated together here: a substantial proportion of Warrego's workforce is located in Tennant Creek; Warrego has no facilities other than a company store and a primary school; and Warrego's inhabitants obtain the bulk of their goods and services in Tennant Creek, which would largely feel any wider economic impact from



Map 3. Tennant Creek Area

closure of the Warrego mine. The 1981 Census data indicate that demographic patterns in Tennant Creek/Warrego are considerably more "normal" than at Alyangula; in particular, the proportion of males in the total population is lower, as is the percentage of males who are single and in the 20-39 age group.[2]

Mine Infrastructure

This section is concerned with the use of infrastructure established in association with the development of Peko's mines.[3] The infrastructure required has been much less extensive than for some of the other case study mines, because Peko was mining low-volume/high-value materials (copper, gold, bismuth), and because small-scale mining had been under way in the region for two decades when Peko began its operations.

Roads: Peko Mines constructed roads from Tennant Creek to each of its mines and financed this work itself, with the exception of some government funding for widening a section of the Tennant Creek/Warrego road. However, each road ends at the mine concerned, i.e. none is a "through" road (see map). This severely constrains their use for non-mining activity, which is restricted to:

i one pastoral property north of Warrego, owned by Peko itself but operated by an independent lessee;
ii a local Aboriginal group based west of Warrego which uses the Warrego road to transport water for domestic use;
iii tourists engaged in fossicking (i.e. looking for precious stones) or visiting the mines;
iv the few small-scale miners still operating in the area.

Power: Peko installed a 20 MWT power station at Warrego, which now operates well below capacity as it was initially designed to provide power to the copper smelter and to Tennant Creek. Peko supplied power to the town until 1974, when the Northern Territory Electricity Commission (NTEC) constructed its own station (according to the company, because of a dispute over a small increase in electricity charges imposed by Peko). The cost of providing power to Tennant Creek from the NTEC station is apparently considerably higher than the cost of increasing output from Peko's plant: $1.2 million higher in 1985, according to the company's calculations.[4] Until recently, NTEC's operations in the NT were subsidized by the federal government; this subsidy is now being removed, and Tennant Creek consumers will presumably pay considerably more

for their electricity than if Peko were supplying it. Thus the opportunity for a significant external economy for electricity consumers apparently exists, though this potential is not currently being realized.

Water: Peko spent in excess of $1 million developing a water supply for Warrego, based on a series of bores and fresh water dams. However, this water supply is used exclusively by the company and its employees, with the exception of Aborigines from a nearby settlement who sometimes collect water for domestic use.

Township facilities: Township facilities at Tennant Creek have been developed gradually over the 50 years since gold was discovered. In 1937, for example, the town had a hospital, a school, two hotels, a post office, police station, bank and some 10 retail outlets.[5] Its facilities now include a secondary school, two primary schools, a modern hospital, banks, a substantial number of hotels, motels, restaurants, supermarkets and speciality shops, and a wide range of recreational and sporting facilities.[6] These facilities, and the town's housing stock, were developed by individuals, mining companies, government, and sporting, charitable and other voluntary organizations.

Peko built houses for some of its employees, while others rented accommodation from the state Housing Commission. With the decline in mining activity, the company has found itself with surplus accommodation on its hands, and it rents this on the commercial market, frequently to ex-employees, a significant number of whom have set up their own businesses in the town.[7] Since 1945, substantial public sector housing construction has occurred, and there is now a well-developed accommodation market in the town; in 1981, 57 percent of households resided in owner/purchaser or housing authority dwellings, compared to 5 percent in Alyangula.[8] Peko Mines also assisted with development of other items of social infrastructure. It took the initiative in setting up, and initially funded, certain community facilities (for example a kindergarten) which were subsequently taken over by relevant government authorities. It also helped develop recreational facilities, in some cases by donating buildings, in others by lending equipment and operators to the groups concerned.[9]

Employment Structure

As indicated above, infrastructure established specifically to permit development of Peko's mines has largely been utilized by the company itself. However, an analysis of Tennant Creek's employment structure shows clearly that the township facilities have been used extensively in

non-mining economic activity. (They are also being used by the other mining company currently developing a small gold deposit near the town, but it will employ only 5 people when in production.) Table 3 presents the 1981 Census Data on employment by industry sector;[10] mining accounted for less than 40 percent of employment, as opposed to 67 percent at Alyangula. Other major sources of employment were Public Administration and Community Services (17.3 percent), Wholesale and Retail Trade (9.1 percent), and Manufacturing (7.2 percent). The bulk of manufacturing fell in the Food, Drink and Tobacco subdivision, most of which was accounted for by abattoir operations.

Given the available resources, it was not possible to undertake a comprehensive survey of employment in Tennant Creek in 1985. However, exact information was obtained from government department and company records on employment in Mining, Abattoirs, Electricity, Gas and Water, Communication, Transport and Storage, Public Administration and Community Services, while a limited survey of major employers and information provided by the Tennant Creek Commonwealth Employment Service was used to estimate employment in the remaining sectors. The relevant figures are presented in table 4.

Two major points emerge from a comparison of the 1981 Census data and table 4. First, employment in mining has declined dramatically, from 824 to 311, or from 40 to 23 percent of the total workforce; during the period 1981-85, Noble's Nob ceased mining operations, Peko closed one of its mines and reduced operations at the other, and shut down its smelter, which had been re-opened in 1979, for a second time. The other point is that the impact of declining mining activity on employment in other sectors has been limited. It is difficult to give precise figures because of the substantial "not classified, not stated" category in the Census data; it would appear from mining company employment records that about fifty of those in this category were actually engaged in mining, in which case non-mining employment declined by about 120 between June 1981 and mid 1985. It is not possible to break this figure down by sector, but Wholesale and Retail Trade and Transport and Storage probably bore a substantial proportion of the losses.

There are a number of reasons for the limited impact of cutbacks in mining operations. First, there has been a strong growth in tourist activity in Tennant Creek during 1981-85, which explains the substantial net rise in employment in the Personal Services sector and which provided some compensation to retailers for the loss of mineworkers' wage and salary expenditure. Tennant Creek is the major stopping-off point for tourists travelling into the NT from South Australia and, according to NT Tourist Commission figures, the number of travellers spending one night

Table 3

EMPLOYMENT BY INDUSTRY, TENNANT CREEK, JUNE 1981

Industry	Males	Females	Persons	%
Agriculture etc.	10	2	12	0.6
Mining	756	68	824	39.7
Manufacturing				
Food, Drink, Tobacco	78	24	102	4.9
Textiles, Clothing	0	2	2	0.1
Metal prods, Machinery	30	4	34	1.6
Other and undefined	8	3	11	0.5
Total	116	33	149	7.2
Electricity, Gas, Water	25	3	28	1.4
Construction	85	9	94	4.5
Wholesale, Retail Trade				
Wholesale trade and Undf.	33	22	55	2.6
Retail trade	58	76	134	6.5
Total	91	98	189	9.1
Transport, Storage	43	9	52	2.5
Communication	26	6	32	1.5
Finance, Property, Business Services	21	19	40	1.9
Public Admin., Defence	93	42	135	6.5
Community Services				
Health	21	64	85	4.1
Education	18	62	80	3.9
Other and Undefined	42	17	59	2.8
Total	81	143	224	10.8
Recreation, Personal, Other Services	22	52	74	3.6
Not Classified and Not Stated	145	77	222	10.7
Grand Total	1,514	561	2,075	100.0

Source: ABS, "1981 Census, Small Area Summary Data".

Table 4

EMPLOYMENT BY INDUSTRY, TENNANT CREEK, MID 1985

Industry	Number	%
Agriculture	n.a.	n.a.
Mining		
Mining	290	20.8
Mineral Exploration and services to mining	21	1.5
Total	311	22.3
Manufacturing		
Food, Drink, Tobacco	215	15.4
Other	12	0.9
Total	227	16.3
Electricity, Gas, Water	31	2.2
Construction	100	7.2
Wholesale, Retail Trade	140	10.0
Transport, Storage	45	3.2
Communication	33	2.4
Finance, Property, Business Services	37	2.7
Public Administration, Community Services		
Health	98	7.0
Education	85	6.1
Police	28	2.0
Transport and Works	89	6.4
Other	67	4.8
Total	367	26.3
Recreation, Personal, Other Services	105	7.5
Grand Total	1,396	100.1

Source: Company and government department records; Commonwealth Employment Service, Tennant Creek.

or more in the town increased from 55,000 to 87,000 or by 58 percent during 1981/82 - 1984/85, while traveller nights rose from 143,000 to 273,000 or by 91 percent.[11] Tourist numbers can be expected to increase further in the short to medium term, because of the surfacing of the Stuart Highway south of the South Australian border, growth of tourist facilities in Darwin, government publicity campaigns, the rapidly-growing popularity of the Kakadu National Park, and the high cost of overseas travel associated with a weaker Australian dollar.

Second, employment in the Food, Drink and Tobacco subdivision more than doubled during 1981-85, due mainly to an increase in abbatoir employment from less than 100 to 211; it now accounts for 15.4 percent of total employment. A new abattoir (which processes horses) was established, operating on a year-round basis and employing about 25 people; the existing cattle abattoir, established in 1980, nearly doubled its workforce, and while its operations are seasonal (five to eight months, depending on climatic and other factors), meat workers earn very high wages and the absolute increase in spending power would thus be considerable.

Third, employment in the public sector did not decline and indeed increased slightly; it now accounts for 26 percent of the total. This partly reflects the necessity to maintain basic services for the remaining population, but also the fact that Tennant Creek has, over the years, developed a function as a regional service centre. This is particularly the case, for example, with departments such as Transport and Works (which carries out road maintenance and other activities throughout the Barkly region), and for Health, Education, Community Development, Primary Production, and Police. The expansion of tourism and meat processing and the maintenance of government programs has helped support employment in the Construction, Transport and Storage, and Business Services sectors, with the result that retail and wholesale activity has also been maintained at reasonably high levels.

Analysis

Tennant Creek, a town which was initially entirely dependent on mining, now provides a base for a range of economic activities, and consequently has a reasonably well diversified economy capable of surviving a drastic decline in mining activity. What explains this development?

First, Tennant Creek (unlike Alyangula) has always been an "open" town. This has permitted the development of a market in accommodation, allowing individual residents and potential residents more freedom of

choice as regards their length of stay, and allowing some mine workers who wished to remain to set up their own businesses. Since Tennant Creek is situated on Crown rather than Aboriginal land, there has been no scarcity of space on which to build additional houses and business premises.

Second, Tennant Creek has had a lower percentage than Alyangula of short-stay, young, single males and as a result has experienced a more substantial demand for retail, personal and social services, helping to widen the economic base. This partly reflects the length of time for which Tennant Creek has been established, partly its status as an open town; the latter has made it easier for people to put down roots and so helped stabilize the population.

Third and perhaps most importantly, Tennant Creek's location and the non-mineral resources in the region have facilitated diversification. The first has allowed it to cash in on the NT's tourist trade, the second to serve as a meat-processing centre for the Barkly pastoral industry; the combination of the two have led to its development as an important regional service centre. Obviously, Tennant Creek's development has been affected in fundamental ways by these specific aspects of its resource endowment.

Though the nature of that resource endowment is of course fortuitous, it is very important to note that its successful expoitation is far from fortuitous, and reflects to an important extent initiatives taken by the Northern Territory government since its establishment in 1978. For example, it has committed very substantial resources ($13.7 million in 1984/85 alone) to promoting the tourist industry whose growth has been so important in maintaining economic activity in Tennant Creek, and to improving tourist facilities in Tennant Creek itself and upgrading major tourist routes through the town. It has invested considerable capital in developing Tennant Creek's role as a regional service centre, funding a construction program which included a new hospital and high school and upgrading of the road system linking the town to its hinterland; the expenditure involved has been vital in maintaining activity in Tennant Creek's construction sector. Substantial resources have also been committed to supporting and encouraging pastoral activity in the region: for example, through disease eradication schemes, subsidies for capital improvements on properties, water provision, and improvement of road access to pastoral leases. By supporting the establishment of the first abattoir in Tennant Creek, the NT government helped to ensure that the value added associated with meat processing would accrue to the town.[12] In other words, Tennant Creek's diversification has not simply happened, but rather has been facilitated and encouraged through a range of government policies and initiatives.

NOTES

1. For details of the town's early history, see H. Tuxworth, Tennant Creek: Yesterday and Today (Darwin: 1978).

2. ABS, "1981 Census, Small Area Summary Data" (Canberra: microfiche).

3. This section is based on field notes taken on two visits to Tennant Creek in November 1984 and January 1985, and on an interview with Peko Mines Operations Manager, Warrego, 15 January 1985.

4. Interview with Peko Mines Operations Manager.

5. Hand drawn map by A. Kelly, Mines Warden, 1937, reproduced in Tuxworth, Tennant Creek, p. 5.

6. For details see Ibid., pp. 73-7; Tennant Creek Regional Tourist Promotion Association, Tennant Creek and Barkly Region (n.p., n.d.).

7. Interview with Peko Mines Operations Manager.

8. ABS, "1981 Census: Small Area Summary Data".

9. Interview with Peko Mines Operations Manager.

10. One significant adjustment has been made to the census data. The figures for Warrego indicate 287 people, or nearly 45 percent of the workforce, in the "not stated" category. It is clear from company employment records that nearly all of these were employment by Peko, and they have consequently been allocated to "Mining".

11. NT Tourist Commission, NT Travel Survey: 1981-2 Summary Report (Darwin: 1982); NT Travel Monitor (Darwin: 1985).

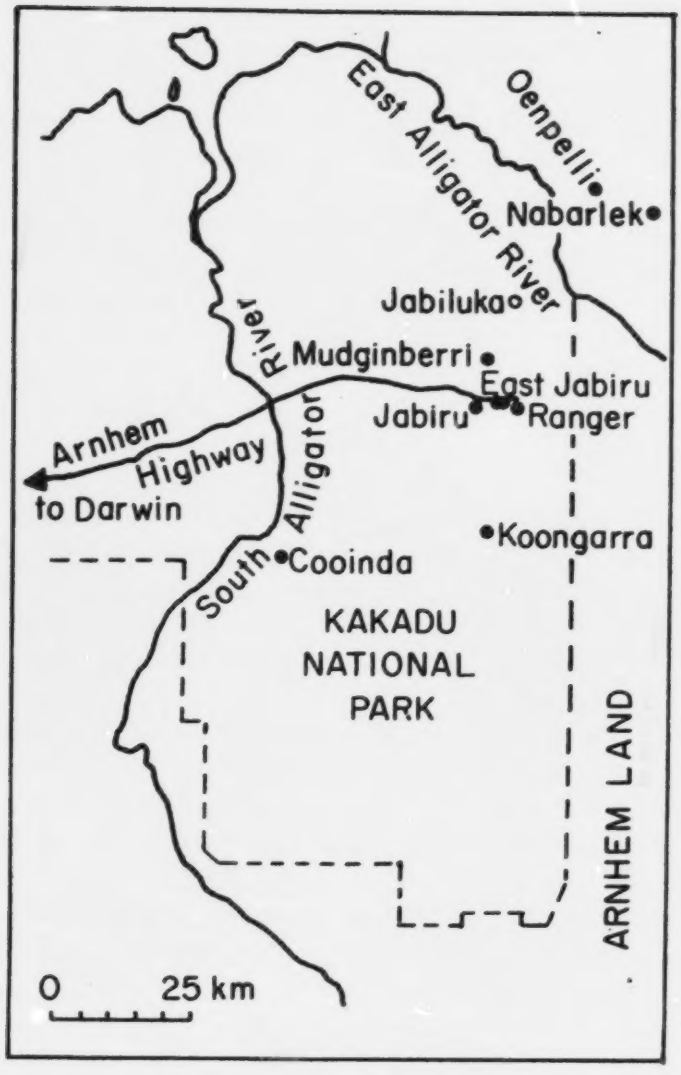
12. For details of these initiatives and of their costs, see Northern Territory of Australia, Budget Papers: No. 1 Budget Speech, No. 5 Capital Works Programmes 1981/2-1985/6 (Darwin: various dates).

5. URANIUM MINING AT JABIRU

Jabiru is unique among mining towns in Australia in having been planned and constructed under a government-established development authority according to guidelines laid down after a wide-ranging public inquiry. It was built as a result of the discovery in 1969 of the Ranger uranium deposits, located about 230 km east of Darwin in the Alligator Rivers Region, and developed during 1979-81 by Ranger Uranium Mines ("Ranger"), a subsidiary of the Sydney-based Energy Resources of Australia Ltd (ERA). The Ranger find was followed by the discovery of smaller deposits at Nabarlek and Koongarra and of a second large orebody at Jabiluka (see map).

While the Aboriginal presence in this region dates back at least 25,000 years, Europeans took up residence in the area only towards the end of the last century. Their presence was minimal until much more recently, reflecting problems of surface communication during the wet season and the very limited opportunities for commercial enterprise, restricted largely to buffalo and crocodile hunting and pastoral activity based on feral buffalo. I do not intend to trace the planning and development of Jabiru in any detail, since this is comprehensively dealt with in a recent book by John Lea and Bob Zehner.[1] However, it is important in the present context to stress a number of points.

First, Jabiru was developed under guidelines laid down by the Ranger Uranium Environmental Inquiry in 1977 and subsequently endorsed by the Commonwealth government. The holding of this Inquiry reflected the fact that Ranger was located within the proposed Kakadu National Park, an area regarded as one of the biologically-richest in Australia and possessing Aboriginal sites of unique cultural and scientific significance, and that the NT's previous experience with uranium mining, at Rum Jungle, had been disastrous in environmental terms.[2] The guidelines laid down by the Inquiry reflected a determination to minimize Jabiru's impact on local Aborigines and on the environment. In particular, it recommended that title over the area be granted to local Aborigines, and that it subsequently be leased back to the Commonwealth and declared a national park. This arrangement would ensure that the Commonwealth, in consultation with local Aborigines, would have considerable influence over the establishment of the town and over its subsequent development; it also meant that there would be no freehold property ownership in Jabiru. The Ranger Inquiry also recommended that, at least for the time being, no accommodation be provided in the town for tourists and that the maximum ultimate population should be set at 3,500.[3]



Map 4. Alligator Rivers Region

Second, the Commonwealth rejected the Inquiry's recommendation that uranium deposits in the region be developed sequentially, and it was initially envisaged that the large Jabiluka find would also be exploited and its workforce housed at Jabiru. As a result, headworks installed in the town (i.e. roads, power and water supplies, sewerage, serviced lots) contain an over-design component, including a substantial number of spare residential lots. Jabiluka was not in fact developed and is unlikely to proceed in the near future, with the result that surplus headworks capacity now exists in Jabiru.

Third, Jabiru was established under the direction of the Jabiru Town Development Authority (JTDA), set up under NT legislation and consisting of public servants and mining company representatives. Initially, it was intended that the latter be drawn from all three companies with identified uranium deposits in the area, but Ranger was the only one of the three granted permission to mine, and it alone was represented on the authority. The cost of constructing the town (including the over-design component) was shared between ERA ($64 million), the JTDA ($8 million), and the Commonwealth government which provided infrastructure grants worth $21 million to the Northern Territory government and expended $4 million directly.

Fourth, under the final cost-sharing agreement negotiated between ERA and the JTDA, firms or individuals wishing to enter the town and use its facilities must pay "New Entrant" costs. In the case of spare lots, these involve the initial cost of development plus accumulated interest charges, or "market value", or Unimproved Capital Value (UCV), whichever is greater; for developed or undeveloped areas, they involve the higher of market value or UCV. ERA has first right of refusal over spare lots and over developed areas within the township, and over undeveloped areas which it requires for establishment of residential lots.[4]

Mine Infrastructure

As was the case with Peko's mines at Tennant Creek, infrastructure requirements for Ranger were influenced by the fact that its product (yellowcake or U308) is high in value but comparatively low in volume. For example, while the value of its output was about four times that of GEMCO's in 1985, Ranger produced only 3,000 tonnes of yellowcake whereas GEMCO produced 1,800,000 tonnes of manganese. Unlike Peko, however, Ranger required the establishment of a completely new township and associated facilities.

Roads: The major road construction required for the project involved upgrading of the Arnhem Highway between Darwin and the South Alligator and its extension to Jabiru (see map); this was undertaken by the Commonwealth government in 1975. In addition, roads were built in the vicinity of the township and between it and the mine at Jabiru East, about 5 km away; the cost of the former was shared between Ranger and the government, while the company paid for the latter.[5]

The Arnhem Highway and the roads in the Jabiru/Jabiru East area are used by Ranger, its suppliers and contractors and their families, but also by local Aborigines and by the very large number of tourists who visit Kakadu individually or as part of group tours. About 100,000 people visited the park in 1985 (see below); many of these would also have visited Jabiru, and some 20,000 toured the mine itself. It was of course the Commonwealth, rather than Ranger, which upgraded and extended the Arnhem Highway, but the impetus for this work came from the discovery of uranium and Ranger did meet a significant proportion of road costs in the Jabiru area.

Airport: An airstrip was constructed at Jabiru in 1970 by the companies which later formed ERA. This was subsequently upgraded, but is still capable of taking only light aircraft. It is used for scheduled flights from Darwin, which carry tourists and local Aboriginal people as well as company and company-related personnel, for charter flights hired by local Aboriginal organizations and groups, and is used extensively by companies offering scenic flights of the Kakadu and surrounding areas to tourists.

Power and water: Ranger installed an oil-fired power station at the mine and transmission lines to Jabiru. Electricity is sold to NTEC which sells it in turn to users to Jabiru, with its practical role being confined to collection of payments from consumers. Currently, power is not supplied to any commercial ventures other than to Ranger's contractors and suppliers and retail outlets, but it will of course be available to any ventures which are established in the future. The same applies to water supply, developed by Ranger from a bore-field some distance from Jabiru; Ranger also paid the cost of constructing reservoirs and a pumping station for town water supply, and part of the cost of water reticulation in Jabiru.

Township facilities: Housing was provided mainly by ERA and government departments and agencies, with a small number being constructed by the firms operating Jabiru's bank and service station; each met its own construction costs, with the cost of developing serviced lots being shared between Ranger and the government. No public housing was constructed for sale or rental to the general public; the JTDA realized that a

serious shortage of housing for private commercial interests would result, but neither the Commonwealth or Territory governments were prepared to provide the required funds.[6] Employees of Ranger's contractors and suppliers and operators of speciality shops are housed in company accommodation or mobile homes, mainly in Jabiru East, and in Housing Commission houses which have not been required for government employees because of the failure of Jabiluka to proceed.[7] If that project does go ahead, or if plans to close down Jabiru East are proceeded with, the current shortage of private accommodation will become much more serious. On the other hand, some 140 residential lots are already developed and additional undeveloped land also exists; these may become available to individuals and (non-mining) firms, particularly if Jabiluka is not developed (see below).

Other township facilities in Jabiru are basically of two types. First, there are those aimed at providing public services, and these were mainly funded by the Commonwealth. The principal ones are a health centre, a school teaching primary and lower secondary levels, police station, court house, fire station, and government offices. A day-care centre and a community hall were paid for by Ranger. Second, there are retail outlets in the town centre and a range of recreational facilities; though now operated by private business interests and sporting and voluntary organizations respectively, these were largely paid for by Ranger. They include a supermarket, a small number of speciality shops, a social club, a swimming pool, playing fields and other sporting facilities. Ranger also paid for provision of services (water, drainage, sewerage, electricity) to the town centre, and met most of the costs involved in developing an industrial site on the edge of the township.

The social services and recreational facilities are mainly used by Ranger and government employees, with one significant exception. Aboriginal people resident in Kakadu, at Mudgenberri, and at Oenpelli (see map) do make use of certain facilities. A substantial number of children attend the Jabiru school, which offers a wide range of educational opportunities; extensive use is made of basic medical facilities offered in the health centre (though not of specialist services); and some Aborigines make regular use of the social club and of sporting facilities.[8] Both local Aborigines and tourists make extensive use of the banking and retail facilities available at Jabiru. The industrial site is currently used only by a handful of firms providing services to Ranger and Jabiru residents, but substantial additional space is available and other firms may make use of this in the future.

Employment Structure

Jabiru was still under construction and mining had not yet commenced when the 1981 Census was taken, and census data would thus provide a poor guide to current or likely future demographic and employment patterns. However, a comprehensive employment survey was undertaken by the author during October-November 1985, based on interviews with commercial enterprises, a postal survey of relevant government departments and agencies, and Ranger personnel and creditor payment records. The information obtained is summarized in table 5.

Mining accounts for 51 percent of total employment, considerably lower than the equivalent figure for Alyangula, which has been in existence for very much longer. Some of this difference is due to the fact that GEMCO itself undertakes some non-mining operations which at Jabiru are carried out by other firms, in particular catering and supermarket operations. However, even if the jobs generated in these areas in Jabiru are added to mining employment, it still accounts for only 57 percent of the total, as opposed to 72 percent in Alyangula. And the Jabiru figure would be considerably lower (about 47 percent) if account were taken of people who are employed in tourist and related activity in Kadadu itself, but who procure goods and services in Jabiru (152 in the 1985 peak season, 115 in the low season).[9]

Two factors account for this difference. First, Wholesale and Retail Trade generates substantially more employment in Jabiru than in Alyangula, 9.5 percent of the total versus 2.9 percent. Presumably, this is largely due to Jabiru's role as a provisioning centre for the substantial number of tourists now visiting Kakadu; retail petrol sales, for example, increase by a factor of ten during the tourist season.[10] Second, employment in Public Administration and Community Services is significantly higher in Jabiru, 128 or 16.8 percent of the total as against 49 or 6.3 percent in Alyangula. This reflects the presence in Jabiru of a number of Aboriginal community or sectional interest organizations, particularly the Gagudju Association which represents local traditional landowners and receives royalty moneys from Ranger, and of a major research facility, the Alligator Rivers Region Research Institute.

A significant proportion of employment in other industry sectors in Jabiru is of course directly or indirectly linked to mining, since it is generated by firms supplying goods and services to Ranger and its employees. Nevertheless, even at this very early stage in its development, Jabiru is showing signs of a potential for economic diversification which is clearly absent in Alyangula 20 years after its establishment. This potential arises mainly from Jabiru's proximity to Kakadu National Park, whose

Table 5

EMPLOYMENT BY INDUSTRY, JABIRU, OCTOBER 1985

Industry	Number	%
Agriculture	0	0
Mining	393	51.2
Manufacturing	1	0.1
Electricity, Gas, Water	3	0.4
Construction	74	9.6
Wholesale, Retail Trade	72	9.4
Transport, Storage	0	0
Communication	9	1.2
Finance, Property, Business Services	37	4.8
Public Administration, Community Services		
Health	6	0.8
Education	36	4.7
Police	12	1.6
Other	74	9.6
Total	128	16.7
Recreation, Personal, Other Services	50	6.5
Grand Total	767	99.9

Source: Ranger records; information provided by government departments and commercial enterprises.

popularity as a tourist attraction is increasing rapidly; visitor numbers rose from 45,800 in 1982 to nearly 100,000 in 1985.[11] For reasons mentioned earlier in discussing tourism in Tennant Creek, it is likely that this growth will be maintained in the short to medium term. Jabiru clearly has the potential to become a major tourist centre for Kakadu and the Alligator Rivers Region generally, and if it does so its economic base will become diversified to a significant extent. Whether it realizes this potential depends on three main factors.

First, concern about social and environmental effects might represent a significant constraint. In this regard, the attitude of local Aborigines, and particularly of the Gagudju Association, will clearly be crucial. There has been some suggestion that Aborigines are strongly opposed to expansion of tourist activity.[12] However, the Gagudju Association has approved the construction of a tourist facility in Jabiru under the next Kakadu National Park Plan of Management, while traditional owners in Kakadu have been quite willing, once they have been consulted and their advice heeded, to permit expansion of facilities and improved access to sites of cultural significance within the park.[13]

Second, there is the question of access to the over-design facilities which currently exist and to the township area generally. As mentioned above, Ranger has right of first refusal over spare lots and developed areas; if its operations expand, which now seems likely, its requirements will take first priority, and the facilities available for tourist and related development will consequently be diminished. There is also the question of how the term "market value" is interpreted in disposing of spare lots and developed or undeveloped land. In an open, competitive market in which JTDA/ERA exercised their full market power, this value would presumably be close to the cost of independently developing the facility involved, which might act as a significant barrier to entry for some tourist and related activities. This possibility would be heightened if mining proceeded at Jabiluka, since the company involved, Pancontinental, would presumably be a determined bidder for a substantial proportion of the available developed land. If, on the other hand, access to overdesign headworks is available to individuals and commercial ventures on what they regard as reasonable terms, the prospects for diversification could be considerably enhanced.

Finally, there is the issue of whether private investors would be willing to commit substantial capital to tourist or other development without the security of tenure offered by freehold property ownership. It seems likely that the Gagudju Association will have a major financial involvement in the tourist accommodation facility now planned for Jabiru, which may provide a solution to the problem in this particular case. How-

ever, the Association's resources are limited, and in the longer term absence of freehold title may represent a significant constraint on investment.

Analysis

The infrastructure developed to permit mining at Ranger uranium clearly has the potential to act as a base for economic activity linked to tourism and to servicing of that industry, of mining, and of the population which both attract to Jabiru. Already some of that potential is being realized as tourists and local Aboriginal people make extensive use of roads, the airport, and certain township facilities. Whether it is realized fully depends to an important degree on the extent to which existing constraints on Jabiru's development as a tourist and service centre are removed.

One of these constraints relates to the availability for non-mining purposes of over-design facilities, arising from ERA's right of first refusal and the requirement to dispose of them at "market value". These restraints reflect ERA's determination to earn some return on the capital it has invested in the townsite, and to ensure that its own requirements receive first priority. However, the JTDA will also be involved in decisions regarding access to township facilities, and it is entirely possible that other commercial interests will be mobilized through the Northern Territory government to ensure that potential users are granted access on "reasonable" terms. Other significant restraints (e.g. limits on town size, on tourist facilities) originated with entities which succeeded in influencing the outcome of the Ranger Inquiry: environmentalists concerned with protecting Kakadu, and Aboriginal and non-Aboriginal groups concerned with the welfare of Aborigines. The extent to which these restraints continue to operate will be determined by political processes involving a variety of interests, including Aboriginal groups which possess a stake in tourism and those which do not, other entities concerned with Aboriginal welfare, the tourist and associated service industries, the environmental lobby, and Jabiru's existing residents. At this stage the outcome of those processes is uncertain, but if the current attitude of local Aboriginal groups remains unchanged it is likely that use of township facilities by tourists will increase significantly in the near future.

NOTES

1. Yellowcake and Crocodiles: Town Planning, Government and Society in the Uranium Province of the Northern Territory (Sydney: George Allen and Uwin, 1986).

2. I. Lowe, The Uranium Industry in Australia (St. Lucia: Australian Studies Centre, Occasional Paper No. 4, 1984), p. 20.

3. Ranger Uranium Environmental Inquiry, Second Report (Canberra: AGPS, 1977), pp. 216-23.

4. JTDA-ERA, "Agreement between Jabiru Town Development Authority and Energy Resources of Australia" (Doc. 10741, 14.05.1985, unpublished), Clauses 10-12, 23.

5. Information on mine infrastructure, its costs, funding, and use is based on Ibid.; on field notes from a number of visits to the area during 1985; and on information provided by the JTDA and by Ranger's Manager, Administration and Finance.

6. Lea and Zehner, Yellowcake and Crocodiles.

7. Information provided by the JTDA.

8. For a detailed discussion of the extent to which local Aborigines use services and facilities at Jabiru, see O'Faircheallaigh, The Impact of the Ranger Mine, pp. 79-82.

9. Author's Survey Data.

10. Ibid.

11. Information provided by ANPWS, Canberra.

12. See, for example, "Aborigines may prefer mines to tourists", NT News, 18 May 1984.

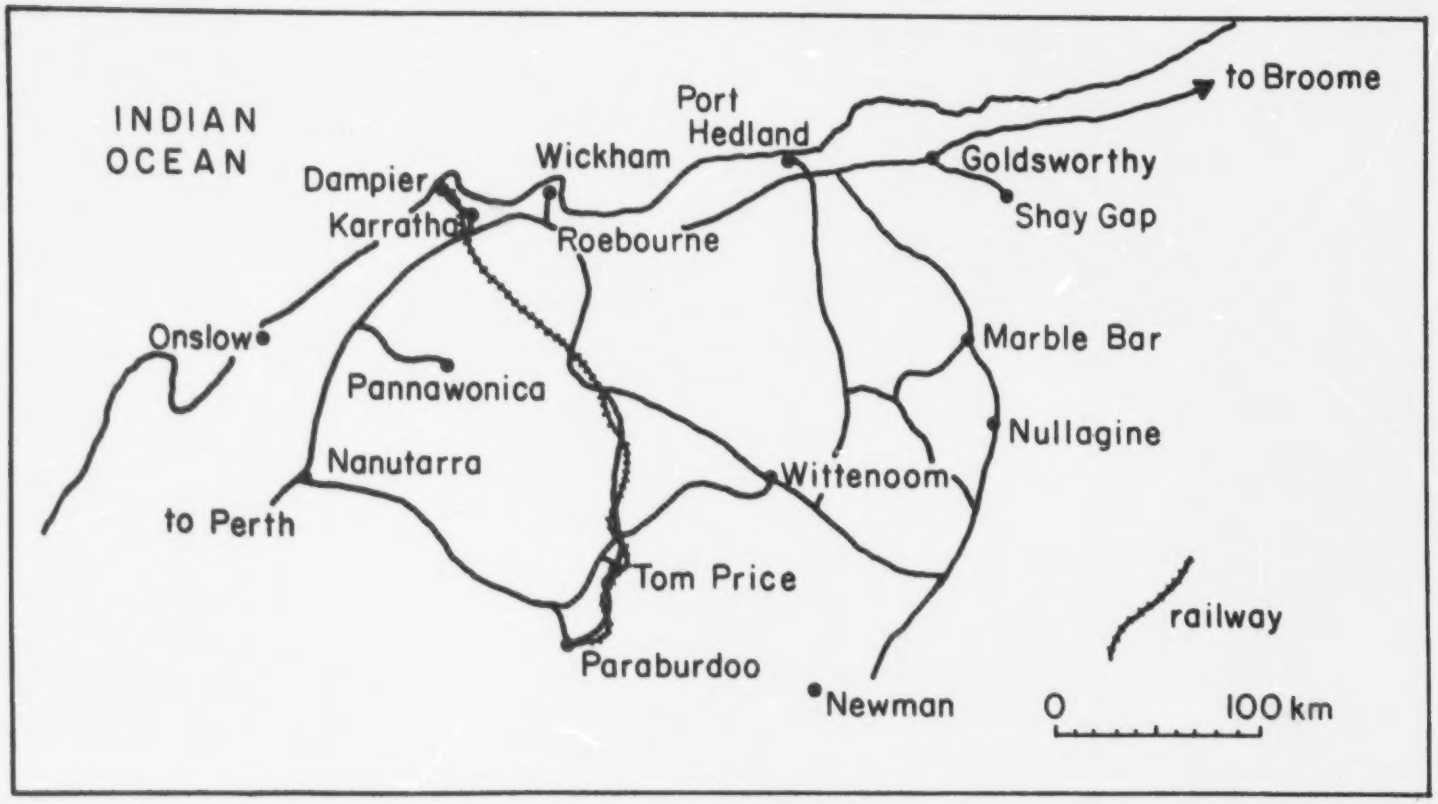
13. Interviews with Park Superintendent, Kakadu Park Headquarters, 15 November 1985; with Gagudju Association's Environment Officer, Patonga Lodge, 10 October 1985.

6. IRON ORE IN THE PILBARA: HAMERSLEY IRON PTY LTD

During the 1960s and the early 1970s, a number of mining companies developed massive, high-grade iron ore deposits in the Pilbara region of Western Australia. These developments were made possible by rapid growth in demand for steel in the major industrialized countries, particularly Japan, and they were to make Australia the world's leading exporter of iron ore by the mid 1970s. The Pilbara is a vast area (some 500,000 sq. km.) which, until the advent of mining, had experienced no large-scale commercial activity other than open range cattle and sheep raising, and this has frequently been marginal in economic as well as environmental terms. The paucity of commercial activity reflected the area's rugged terrain, its arid climate (25-33 cm rainfall annually) and its remoteness (over 1,000 km from the nearest major urban centre, Perth). Establishment of the iron ore industry consequently required infrastructure development on a massive scale, particularly since the companies concerned were exploiting a high-volume/low-value mineral located in deposits hundreds of kilometres from the coast. This chapter deals with the operations of the largest single iron ore producer, Hamersley Iron Pty Ltd ("Hamersley"), a wholly-owned subsidiary of Conzinc Riotinto of Australia Limited (CRA).

In 1962 CRA geologists discovered the large and rich iron ore deposit later named Mt. Tom Price. Long-term contracts were signed with Japanese steel mills, loan finance was raised from North American banks, a township established at Tom Price, and a port and second township constructed at Dampier on the coast. By August 1966 ore shipments had commenced. In January 1970 additional long-term contracts were signed with the Japanese, the Mt. Tom Price mine was expanded, a second mine and third township established at Paraburdoo some 50 km to the south, and additional housing and other facilities developed near Dampier, in an "open" town set up jointly with the state government at Karratha (see map). A concentrator was subsequently established at Mt. Tom Price to treat lower grade ores, a pelletization plant was built at Dampier to upgrade iron ore mines, and by 1976 ore shipments reached 36 million tonnes. Mt. Tom Price and Paraburdoo now have a combined capacity of 46 million tonnes of saleable ore, and are currently producing at close to this level; Hamersley's proven reserves of high-grade ore are sufficient to maintain production at current levels for over a century.[1]

The following sections provide details regarding the infrastructure constructed to permit exploitation of Hamersley's deposits, and indicate the extent to which it is used for other purposes.



Map 5. Pilbara Iron Ore Province

Port Facilities: Hamersley developed port facilities at Dampier, installing two ore loading berths at Parker Point and on East Intercourse Island (to which it constructed a causeway) and building a small service wharf. A Hamersley subsidiary operates a number of tugs to assist with berthing operations, and provides a pilotage service.

Hamersley's port facilities at Dampier are specialized and geared almost entirely towards iron ore loading; to date they have been used solely for this purpose and to import fuel oil and small quantities of other inputs for the company's operations. In 1979, for example, Hamersley's berths handled 30 million tonnes of ore, 240,596 tonnes of fuel, and only 354 tonnes of general cargo.[2] A salt mining company, Dampier Salt (also owned by CRA), does use the port; it installed its own loading facilities and pays commercial rates for tug and pilotage services provided by Hamersley,[3] but the latter's investment in developing the port site may have contributed to the economic feasibility of establishing the Dampier Salt operation.

Railways: Hamersley constructed 293 km of railway between Dampier and Mt. Tom Price in the mid 1960s, and subsequently added a further 100 km, to Paraburdoo. The railway is predominantly single track with by-pass sidings, and its primary purpose is to ship iron ore to the coast; a standard train consists of three locomotives hauling 180 or 210 ore cars which carry up to 25,000 tonnes of ore. Twice a week goods trains carry fuel oil and other mine supplies from Dampier to the mines. Hamersley also developed extensive workshop facilities near Dampier capable of routine maintenance and major repairs on locomotives and ore trucks; these facilities have to date been used solely by Hamersley's Rail Division.[4]

The original development agreement negotiated with the state government provided that Hamersley "transport the passengers and carry the freight of the state and of third parties on the railway ... upon reasonable terms and at reasonable charges (having regard to the cost of the railway to the company)...".[5] In practice, use of the railway has been almost entirely restricted to Hamersley's ore and its incoming mine supplies; the only exceptions involve the small proportion of fuel oil cargoes which is sold through service stations in Tom Price and Paraburdoo, and individual items of equipment shipped for Hamersley contractors or for community or sporting groups run by company employees.[6] A number of factors account for this situation. First, the railway was designed to quite narrow specifications and is not suitable for certain types of rolling stock. Second, Hamersley has strict guidelines regarding permissable cargoes and as an organization is not geared towards handling small quantities of general freight, both of which lead potential customers to use road freight services. Third, Hamersley's existing rolling stock is

specialized and in general not suitable for any purpose other than transporting very large quantities of bulk materials, and to date no other enterprise has produced such materials adjacent to the railway. The only potential users would appear to be nearby pastoral properties, but transport of cattle would require rolling stock of a quite different type, and in any case stock transport routes are not oriented towards Dampier.[7] It is of course possible that new mining ventures will be established in the region. Hamersley's official position is that the companies involved could have access to its railway providing that:

i user charges were at a level which would give Hamersley an appropriate return on either the existing investment if rail capacity was underutilized, or the additional investment needed to increase capacity should this be required;

ii use of the railway did not adversely affect the efficiency of Hamersley's own operations or lead to a deterioration in the quality of the rail link.

The company is opposed to the concept of public provision of railways, with each user paying appropriate charges to the government; it believes that company ownership and control is essential to the efficiency of its ore freight operations, and that any third party should negotiate user charges with Hamersley.[8]

Roads: When iron ore mining commenced in the Pilbara, the only major road in existence was the North West Coastal Highway which linked the region with Perth, and this was unpaved. In the early 1970s the state government implemented a major program to pave it as far as Port Hedland, at a cost of $31 million. It is now in the process of paving the road connecting Paraburdoo and Tom Price with the Coastal Highway at Nanutarra (see map), and has already paved the Tom Price - Paraburdoo road initially built by Hamersley. The company's other major work in this area involved construction of an unpaved road which follows the railway to Dampier, and is primarily designed to provide access to the railway for inspection and repair crews.[9] Thus, as mentioned in the earlier discussion of WA's infrastructure policies, a considerable proportion of the cost of establishing or upgrading roads has fallen on the state government.

The roads constructed by Hamersley are almost entirely used by the company, its employees, their families, and others associated with its mining operations. Few tourists visit Paraburdoo or Tom Price. To do so requires a major diversion from the main tourist routes, and there are few tourist attractions in the area other than the opportunity to visit the

mines There are very few tourist facilities in either town; in particular neither provides low-cost accommodation in the form of trailer parks or camping grounds. Tourists are generally not aware of the existence of the railway maintenance road, but permits are issued to any who wish to use it. Apart from rail crews, it is used mainly by Hamersley staff travelling to Dampier and by a small number of local pastoralists.[10]

Airports: Hamersley constructed three air strips, at Tom Price, Paraburdoo and Dampier. Tom Price is still a private facility which takes only small and medium-sized planes, and it is used almost exclusively by company aircraft. Dampier, which now also services Karratha, was upgraded to take jet aircraft and is now operated by the Commonwealth Department of Aviation, which recoups its operating expenditures through imposition of standard user charges. Paraburdoo was upgraded to a similar level; it too is operated by the Department of Aviation, but in this case operational and maintenance costs are met by Hamersley, though some of these are subsequently recouped from the Department.

Both Paraburdoo and Dampier/Karratha are now included in scheduled jet services between Perth and the Pilbara. Paraburdoo is still very much dominated by Hamersley's operations, and since the town is not a tourist destination air services to it are used predominantly by company employees, other township residents (e.g. contractors' employees, public servants), and visitors on company business. Karratha, on the other hand, is now developing into a regional centre (see below), and air services are consequently used by a wider range of people.

Power: Hamersley's main power source is a 120 MW steam turbine station at Dampier, currently being converted from oil to natural gas. This has more than sufficient capacity for all of Hamersley's operations since the pelletization plant, a major consumer of electricity, had proved uneconomic to operate by 1980 and was "mothballed"; power is transmitted from Dampier to Tom Price and Paraburdoo. Both originally possessed 30 MW diesel generators; the Tom Price plant has been closed, while Paraburdoo now has a 20 MW gas turbine which is essentially maintained as an emergency supply for the two mine towns in case of failure in the transmission line.[11]

In 1979-80 the State Electricity Commission of Western Australia (SECWA) installed a 20 MW gas turbine in the Dampier power station to help meet the increased demand for power in Karratha. During the period 1980-84, Hamersley supplied power to SECWA at a price based on the cost of fuel and a proportion of fixed charges incurred by Hamersley in operating the power station. (SECWA now purchases electricity from another Pilbara mining company.) Hamersley has also supplied electricity to a number of commercial users in Dampier: for example, to Dampier

Salt and the Dampier/Karratha airport at charges based on standard SECWA rates.[12] No consumers take power from the transmission line to Tom Price and Paraburdoo. The only potential customers are pastoral properties; they already have their own power supplies, and while Hamersley might be able to supply electricity more cheaply, the cost of making the required voltage conversion for individual properties is prohibitive.[13]

Thus while Hamersley's power facilities have been used by a number of other entities, SECWA has met the full costs of production for power it takes, while consumers have paid the standard SECWA charges, and thus neither have benefitted from external economies generated by the company's operations.

Water: Hamersley installed a water supply system for each of the company towns. Dampier's water is piped from a bore-field some 140 km south of the town; this system is now operated by the state government. The Tom Price supply comes from an underground aquifer some 40 km from the town, while at Paraburdoo a series of bores have been developed; Hamersley has retained control over both these systems, presumably because of the vital role of water supply in mining and milling operations.[14]

Use of the Tom Price and Paraburdoo systems is entirely confined to the company, its contractors, and employees of both; the only other potential users are pastoral properties, but these already had their own supply systems.[15] Some commercial ventures in Dampier make use of the water supply installed by Hamersley; no details were available regarding payment for this service, but since it is now operated by the state government users presumably pay standard water charges.

Township facilities: Hamersley constructed all of the facilities initially developed at Dampier, Tom Price and Paraburdoo. Karratha was originally developed jointly with the state government, Hamersley funding house construction for its workers and meeting a substantial part of the cost of education, health, recreational and other facilities. By the mid 1970s it was clear that Karratha would fulfill a regional service role; since that time it has been developed by the Roeburne Shire Council, using funds available to local governments generally and contributions from individual resource companies where an increase in infrastructure capacity is clearly linked to their particular requirements.[16]

The three towns constructed by Hamersley were administered by the company until 1983, when an agreement was signed with the Shire of West Pilbara in which it undertook to progressively take over all facilities of a municipal nature and to provide most town services previously supplied by Hamersley. At the same time, the company launched a Home Ownership Plan to allow the sale of homes to employees, and by 1985 over 300

had joined the plan. These moves are designed to implement a process of "normalization" which will convert "closed" company towns to communities with "normal" patterns of service provision and home ownership.

All three towns possess a hospital and primary school, while Tom Price and Paraburdoo have secondary schools; all three also possess a range of recreational and sporting facilities. Paraburdoo has a motel, Mt. Tom Price a pub with a small number of accommodation units attached, and Dampier has no hotel/motel accommodation. Retail facilities are limited in all three centres, typically consisting of one supermarket, a bank, a handful of speciality shops, and in the mine towns a number of retail and service outlets operated from their homes by company employees or their wives. Of the three, only Tom Price provides access to serviced lots for industrial concerns.

At present there is no accommodation market in either Dampier, Tom Price or Paraburdoo. Dampier has no private accommodation, while the other towns have only a handful of houses not built by Hamersley or by government departments for their employees; in Tom Price, for example, there were only three in 1985, one built by the local dentist, two by the state Housing Commission.[17] It is not possible to regard houses being purchased under the Home Ownership Plan as "private" and so constituting the basis for a housing market, since they must be sold back to Hamersley if disposed of within 15 years. As "normalization" proceeds, some additional accommodation may become available, but as yet there are apparently no plans for public housing construction on any significant scale.

Use of the three Hamersley towns for activities not linked directly to mining is very limited; the facilities they provide are used almost exclusively by employees of Hamersley and its contractors and by their families. In most cases, there is an absence of adjacent communities which lack access to the social services and community facilities available in these towns. The other major economic activity in the region, the pastoral industry, may make some use of their facilities, but this is limited by the narrow range of retail and other services available in the Hamersley towns and by the small number of individuals involved in pastoral activity in the region (137 in 1981: see table 6 below).

Karratha, whose initial development was, as mentioned above, partly funded by Hamersley, has developed a more diverse range of functions: it acts as a service base for the North West Gas Shelf project; it is a stopping-off point for the (still limited) number of tourists who travel up the North West Coastal Highway; its retail and personal and business services are utilized by residents of the mine towns and by pastoralists; and it is the administrative centre for Roeburne Shire and for state government and a number of Commonwealth government departments.[18]

Employment Structure

Table 6 provides some information on employment structure in the region in which the Hamersley mines are based, using data from the 1971, 1976 and 1981 Censuses. The boundaries of the relevant collection district were changed between 1971 and 1976, and so the figures for 1971 are not strictly comparable with those for the two later years. An additional problem is created by the size of the "Not Classified and Not Stated" category in 1976 (16.3 percent of the total). Nevertheless, the basic picture is clear. There is no sign of diversification away from mining and related activity, and indeed the dominance of mining has increased; its share of employment rose from 41.1 percent in 1971 to 55.6 percent in 1981. Employment in manufacturing is insignificant (0.7 percent in 1981); that in agriculture increased from 1.8 in 1971 to 3.5 percent in 1976, due to the re-drawing of census district boundaries, but declined to 2.9 percent in 1981.

There were two other major changes over this period. First was the sharp decline in construction employment, reflecting the completion of major building projects at the mine sites. It seems likely that this decline was much less drastic than the figures indicate (28.3 percent in 1971, 3.5 percent in 1976), and that a substantial proportion of those in the "Not Classified and Not Stated Category" were in fact construction workers; construction employment accounted for 8.5 percent of the total in 1981. The second was the substantial increase in employment in "Community Services", from 3.4 percent in 1971 to 6.7 percent in 1981, reflecting the development in the mine towns of a fuller range of education, health and other social services.

It is of course possible that the stimulus to more broadly-based economic activity created by mining and related infrastructure could have been felt away from the mine towns themselves, for example in port and other coastal towns such as Dampier/Karratha, Wickam and Port Hedland (see map). Table 7 provides employment data for the Pilbara region as a whole, which encompasses all of Hamersley's operations and those of the other iron ore companies, and whose census boundaries have been unchanged since 1971. Mining employment is less significant than in West Pilbara, though again it accounted for a substantially higher proportion in 1981 (38.7 percent) than a decade earlier (30.2). It should also be noted that a large percentage of those employed in the "Transport, Storage" sector are in fact mining company personnel who operate the iron ore railways and port facilities. The share of employment accounted for by both agriculture and manufacturing fell over the period 1971-81, from 2.7 to 1.5 and 3.7 to 1.9 percent respectively. As in the West Pilbara, and

Table 6

EMPLOYMENT BY INDUSTRY, TABLELAND (1971), AND WEST PILBARA (1976 and 1981)

Industry	1971		1976		1981	
	No.	%	No.	%	No.	%
Agriculture etc.	44	1.8	144	3.5	137	2.9
Mining	1,027	41.1	2,244	54.9	2,604	55.6
Manufacturing	26	1.0	14	0.4	31	0.7
Electricity, Gas, Water	9	0.4	21	0.5	32	0.7
Construction	706	28.3	143	3.5	400	8.5
Wholesale, Retail Trade	118	4.7	189	4.6	191	4.1
Transport, Storage	30	1.2	67	1.6	67	1.4
Communication	16	0.6	23	0.6	39	0.8
Finance, Property, Business Services	128	5.1	64	1.6	202	4.3
Public Admin., Defence	13	0.5	22	0.5	64	1.4
Community Services	85	3.4	212	5.2	316	6.7
Recreation, Personal, other services	162	6.5	279	6.8	327	7.0
Not Classified and Not Stated	133	5.3	667	16.3	277	5.9
Grand Total	2,497	99.9	4,090	100.0	4,687	100.0

Source: ABS, Collection District Summary Files: Computer Print-Outs and Microfiche, 1971, 1976, 1981 Census.

Table 7

EMPLOYMENT BY INDUSTRY, PILBARA DIVISION, 1971, 1976, 1981

Industry	1971		1976		1981	
	No.	%	No.	%	No.	%
Agriculture etc.	455	2.7	292	1.5	360	1.5
Mining	5,019	30.2	7,402	37.0	9,082	38.7
Manufacturing	617	3.7	486	2.4	449	1.9
Electricity, Gas, Water	155	0.9	457	2.3	438	1.9
Construction	4,603	27.7	1,573	7.9	2,163	9.2
Wholesale, Retail Trade	883	5.3	1,050	5.3	1,720	7.3
Transport, Storage	847	5.1	1,102	5.5	1,708	7.3
Communication	136	0.8	153	0.8	244	1.0
Finance, Property, Business Services	561	3.4	907	4.5	950	4.1
Public Admin., Defence	205	1.2	260	1.3	388	1.7
Community Services	525	3.2	1,380	6.9	2,029	8.7
Recreation, Personal, other services	882	5.3	1,313	6.6	1,465	6.2
Not Classified and Not Stated	1,464	8.8	3,624	18.1	2,455	10.5
Grand Total	16,626	100.0	19,997	100.0	23,451	100.0

Source: ABS, Collection District Summary Files: Computer Print-Outs and Microfiche, 1971, 1976, 1981 Census.

for similar reasons, construction employment declined in significance (from 27.7 to 9.2 percent) and that in community services increased substantially (3.2 percent to 8.7 percent). Employment in retail and wholesale trade rose from 5.3 to 7.3 percent and that in transport and storage to a similar extent, while the share of other sectors remained essentially unchanged.

Thus there is little sign of significant diversification in the Pilbara economy. Employment in agriculture and manufacturing has fallen in absolute terms and as a proportion of the total. Other significant changes reflect the shift in iron ore operations from developmental to operational activity, and so in employment from construction to mining and transport and storage, and the development in the Pilbara of a wider range of retail and social services for the mining and port communities.

Analysis

The establishment of Hamersley's iron ore mines in the Pilbara required very large investments in industrial and social infrastructure. However use of this infrastructure for non-mining activity has been minimal, and indeed less extensive than in any of the other cases examined here. Port facilities and railways have been used exclusively for shipping iron ore, while airports, townships, water supplies and roads built by Hamersley have been used almost entirely by the company, and its employees and those of companies and government department servicing Hamersley and its workforce. Some use has been made of Hamersley's power supply by outsiders, but consumers have generally paid standard SECWA rates for electricity and have consequently not reaped substantial external economies. Only infrastructure associated with the township of Karratha (including the Dampier/Karratha airport) has been used more widely. In this case, part of initial establishment costs were met by the state government, and the town has been deliberately developed as a regional centre with additional funding being provided by local government and a number of other resource companies.

The principal reasons why infrastructure has not been more widely used are as follows.

i Much of it is functionally specialized and suited only to shipment of bulk raw materials such as iron ore. Hamersley clearly feels that the economic benefits associated with operating specialized, single-purpose facilities far outweigh any potential benefits associated with having other parties utilizing its facilities.

ii Because of the paucity of large-scale commercial activity in the Pilbara, itself a reflection of the region's resource endowment, there are few potential users for the company's infrastructure. The only exception is the pastoral industry, which either already possesses the required infrastructure or whose needs differ to Hamersley's either in terms of the physical characteristics of infrastructure or its geographical orientation.

iii There were few existing communities adjacent to the mine and port sites which could utilize the social infrastructure developed by Hamersley, while the low level of tourist activity rules out usage by a substantial transient population.

Given the paucity of large-scale commercial activity prior to mining, and given that mine infrastructure is not now being utilized in such activity (other than in mining itself), it is not surprising that the Pilbara economy shows little sign of diversification. During the period 1971-81, mining and associated transport activity became more dominant as a source of employment, with construction declining and manufacturing and agriculture stagnant or falling. There has been some growth in employment in retail and public services, but the recipients of these services are themselves mineworkers and, unless significant diversification occurs in the future, employment will remain closely tied to the fortunes of the iron ore industry.

NOTES

1. Information on Hamersley's operations, on its infrastructure, and on use of relevant facilities by outsiders is based on field notes taken on visits to Mt. Tom Price, Paraburdoo, Dampier and Karratha during August 1985; from interviews with individual Hamersley Iron personnel, referred to below, and from the following Hamersley publications: Hamersley Holdings Ltd, Annual Report, 1977-1983; Hamersley Iron, Operations of Hamersley Iron (n.p.: 1977); Hamersley Iron Limited: Resources, Technology, Operations (Perth: 1985); Hamersley Iron (Perth: 1985).

2. Hamersley Holdings Ltd, Annual Report, 1979, p. 10.

3. Interview with Hamersley's Senior Liaison Officer, Dampier, 13 August 1985.

4. Interview with Hamersley's Administration Manager, Rail Division, Dampier, 13 August 1985.

5. Iron Ore (Hamersley Range) Agreement 1963, Clause 10 (2) (a).

6. Interview with Hamersley's Administration Manager, Rail Division.

7. Ibid. Stock are generally shipped south for fattening or slaughter.

8. Interview with Hamersley's General Manager, Marketing and Development, Perth, 8 August 1985.

9. Interview with Hamersley official, Administration and Finance Division, Mt. Tom Price, 12 August 1985.

10. Ibid.

11. Interview with Hamersley official, Power Administration, Dampier, 13 August 1985.

12. Ibid.

13. Interview with Hamersley official, Administration and Finance, Mt. Tom Price.

14. Ibid.

15. Ibid.

16. Interview with Shire Clerk, Roeburne Shire Council, Karratha, 13 August 1985.

17. Interview with Hamersley official, Administration and Finance, Mt. Tom Price.

18. Information on the Hamersley towns is based on Ibid.; on interviews with the Shire Clerk, Roeburne Shire Council, and with Hamersley's Superintendent, Employee Relations, Paraburdoo, 12 August 1985; on field notes from visits to the towns; and on the Hamersley publications mentioned in note 1 above.

7. CONCLUSION

The case studies lead to a number of conclusions regarding the extent of external economies associated with mine infrastructure and of its contribution to more broadly-based economic development. This chapter briefly draws those conclusions, after which it examines the implications of the case study findings for government policy on provision of mine infrastructure and for the broader debate on the political economy of remote resource regions.

Industrial infrastructure: Industrial infrastructure installed for the projects reviewed above has in general not been utilized in non-mining commercial activity. The only significant exceptions relate to:

i the (short-lived) use of some GEMCO facilities by a prawn-processing venture and the continued use of its refueling facilities by prawn trawlers. While availability of GEMCO's infrastructure may have allowed the firms involved to reduce costs and so increase incomes, it should be noted that their activities would have occurred in any case. In other words, the existence of GEMCO's infrastructure did not result in the development of additional non-mining economic activity;

ii use of Hamersley's power facilities by a number of consumers in Dampier, at standard State Electricity Commission rates;

iii use of Ranger's roads and airstrip by tourists visiting Jabiru.

In a number of cases, transport infrastructure, power and water were utilized by local residents of the mine area. Aboriginal people at Angurugu used GEMCO's port facilities, power supply, airport, and roads. Small numbers of Aborigines made use of the water supply developed by Peko Mines and of roads built by the company to transport the water obtained. A handful of pastoralists utilized Hamersley's railway access road.

Social infrastructure: The extent to which social infrastructure was used in non-mining activity varied very considerably from case to case. Alyangula's facilities and services were used almost entirely by GEMCO and by mining and mining-related personnel, though some local Aborigines did use certain facilities. The Hamersley towns were to all intents and purposes used exclusively by company and company-related personnel, though Karratha, which Hamersley helped to establish, does now provide

services to a number of resource projects and their workforces. Tennant Creek, on the other hand, is a base for extensive tourist and meat-processing activity and a regional centre for delivery of public services. Jabiru is being used as a provisioning base by large numbers of tourists, and clearly has the potential to develop into a major tourist and service centre, while local Aboriginal people make use of some of its services and facilities.

Use of infrastructure established for the projects examined here in other mining operations is also limited, being confined to a very small gold mine utilizing Tennant Creek's township facilities and a salt mining company which developed shipping facilities in the port developed by Hamersley. This situation may of course change in the future if significant new discoveries are made by other mining firms, though it cannot be assumed that existing operators would make infrastructure available on acceptable terms.

What factors explain the limited use of industrial infrastructure, and the substantial variations which occur in use of social infrastructure from case to case?

As regards the first question, the complete or almost complete absence of existing large-scale commercial activity is obviously a major factor. But of course the central issue in the present context is whether mineral development can, by providing basic industrial and social infrastructure, lead to the establishment of such activity? A vital factor in determining this issue, and in explaining variations in the use of social infrastructure, is the location of particular projects and especially the non-mineral resource endowment of the surrounding region. Both Groote Eylandt and the Pilbara lack resources which might support alternative forms of economic activity, such as agriculture or tourism, while their extreme remoteness raises costs and so reduces the prospects for establishment of raw material processing and service and light manufacturing industries. On the other hand, Tennant Creek's location astride a major tourist route and close to the pastoral properties of the Barkly Tablelands, and Jabiru's proximity to an area of major environmental and archaelogical significance, have provided the potential for use of mine infrastructure in more broadly-based economic activity.

Location is also important in that proximity to existing communities with a limited range of facilities and services increases the possibility that social infrastructure will be utilized by people not connected with the mining project. Thus the external economies associated with social infrastructure at Alyangula and Jabiru largely arise because both are close to Aboriginal communities whose access to retail, transport, and social services was previously limited.

While location and regional resource endowment are important, other factors are also involved. Government policies in a range of areas are of considerable significance, a point illustrated in different ways by both Tennant Creek and Jabiru. In the former, the fact that social infrastructure originally developed for mining now supports other economic activities is due in part to the NT government's use of public funds to encourage tourism, pastoral activity, meat processing and development of Tennant Creek as a regional centre. Some tourist and meat processing activity would probably have occurred in any case, but almost certainly on a smaller scale, while public investment was crucial in developing the town's regional service role (and in the process stimulating construction and retail activity). On the other hand, government policies on land use, on provision of public housing, on town size, and on types of permissable commercial activity have inhibited and may in the future inhibit Jabiru's development as a tourist and service centre. In Alyangula legislation designed to restrict alienation of Aboriginal land has severely restricted the area available for construction of the housing and business premises required if additional economic activity is to occur.

The question of whether mine townships are "closed" company towns or "open" public communities is also important, particularly because it largely determines whether a free market develops in housing and other accommodation, which in turn influences the prospects for establishment of commercial activities. This is particularly so as regards small-scale ventures, since availability of accommodation is crucial in determining whether individuals can remain in mine towns and set up small service or light manufacturing establishments after terminating their employment with a mining company, contractor, or government department. This point is illustrated by the experience of Tennant Creek, where a number of Peko Mines' employees have left the company but remained in the town and set up small businesses, initially servicing Peko but subsequently widening their sales base. The existence of numerous small establishments, many of which could not have come into existence in the absence of a "free" accommodation market, helps to explain the fact that the retail and personal services sector accounts for 17.5 percent of total employment in Tennant Creek, compared with 8.0 percent in Alyangula and 11.1 percent in the West Pilbara.

Existence of an accommodation market also makes it easier for the population of mine towns to stabilize and develop a more "normal" demographic profile. This affects prospects for widening the economic base, since towns with a large percentage of young, short-stay, single males are denied the additional stimulus to retail and social services generated by a population with a higher proportion of families. Demographic pat-

terns are, of course, influenced by company recruitment policies; in recent years a number of companies in North Australia, including GEMCO, have deliberately set out to recruit married rather than single men, and this has affected the composition of mine town populations and their stability. The timing of project development can also be significant in this regard. GEMCO's operations, for example, developed gradually from a small base over nearly a decade, with the result that some key facilities and services were not available for some time. This may help to explain why the company's workforce continued to be unstable and have a high proportion of single males until very recently.

Finally, there is of course the physical nature of the infrastructure itself. Much industrial infrastructure developed by mining companies tends to be highly specialized and not suitable for use in other commercial activities. In addition, the companies themselves are specialized organizations which are not geared towards making infrastructure services available to other users. Both factors clearly militate against use of mine infrastructure for other commercial activities.

What are the implications of these findings for government policies on provision of mine infrastructure? First, they indicate that in many cases mine infrastructure will not generate significant external economies and will not contribute substantially to more broadly-based economic development. It was argued in chapter 2 that the prospect of reaping substantial external economies represents the major justification for departures from the "user-pays" principle. It would seem, therefore, that in such cases governments should not commit public funds to development of infrastructure or subsidization of services in remote areas, but should pursue policies of the type implemented by Queensland since the early 1970s, which were designed to minimize the demands made on that state's tax payers by resource-related infrastructure development.

Second, they indicate that, in gauging the likelihood that significant external economies may emerge, governments should pay very careful attention to the location of proposed projects in relation to existing communities and to resources capable of supporting other forms of economic activity. The discussion in chapter 2 indicated that there is little justification for determining the extent of public funding of mine infrastructure on a case-by-case basis if the criterion applied is whether a project will be sub-marginal in the absence of such funding. However the conclusions drawn above indicate that a case-by-case approach may make considerable sense if proximity to existing under-serviced populations and the resource endowment of surrounding regions are the criteria applied.

Third, there is clearly a need to integrate policy on provision of mine infrastructure with policies on a wide range of other issues. It makes little sense, for example, to invest public funds in mine infrastructure on the assumption that it will encourage non-mining economic activities if policies being pursued in other areas inhibit growth of these activities. Such policies could relate, for example, to land use, provision of public housing, industry promotion, and more broadly to allocation of government current and capital expenditure. On the other hand, co-ordination of government initiatives in various policy areas can clearly increase the potential of mine infrastructure to support more broadly-based economic development.

Fourth, in determining whether or to what extent public funds should be invested in mine infrastructure, government should take into account those policies of individual mineral developers which are likely to affect the prospects for emergence of more broadly-based commercial activity. Of particular importance are company policies on administration of and public access to mine townships, on labour recruitment, timing of project development, and on design of industrial infrastructure and its use by other parties. In some cases, of course, government may be able to influence company policy, for example by making grants of mineral leases or public provision of infrastructure dependent on establishment of "open" towns with a free accommodation market, or on routing of transport infrastructure so as to maximize its potential usefulness for non-mining activities.

As regards the more general debate on the political economy of remote resource towns and regions, it is evident that the claims made by Australian mining industry spokesmen, politicians and senior bureaucrats regarding the potential of mining projects and associated infrastructure to simulate broadly-based economic development are unduly optimistic. In a substantial number of cases they are extremely unlikely to have this effect, while in some others they will do so only if government and company policies are favourable. However, neither does the pessimistic view espoused by academics such as John Bradbury and Peter Newton seem valid as a generalization. Indeed the case study material reveals a number of important weaknesses in the analytical framework they employ.

Of particular importance is the fact that the political analysis offered by that framework is over-simplistic, because it focuses almost exclusively on the relationship between resource corporations and (supposedly co-operative) domestic elites. It appears to ignore any prospect for the emergence and articulation of social and economic interests in the resource region other than those represented by the multinational corporation, the pliant local elite, and the mine workforce. It also ignores the possibility

that other social and economic interests might in fact prevail on the state, or on certain parts of the state apparatus, to act on their behalf rather than exclusively on behalf of multinational corporations. Underlying this simplistic approach to politics is a failure to adequately recognize the significance of the particular non-mineral resource endowments of specific mineral-producing regions.

Tennant Creek and Jabiru illustrate these points. In Tennant Creek, economic and social interests separate to those of the mining industry have emerged (e.g. pastoralists, the tourist industry, small business), and have been successfully articulated through the state political system. The NT government, until recently headed by Tennant Creek's Member of Parliament, Ian Tuxworth, has acted in support of these interests by initiating public expenditures in the town and its hinterland along lines described in detail above.

Even if the successful articulation of these alternative economic interests did not lead to conflict between the local political elite and mining corporations, their existance would indicate the need to look beyond a one-dimensional view of resource region politics, with important implications for the long-term prospects for diversification and more broadly-based economic development. In fact, the necessity to finance expenditures of the type undertaken in Tennant Creek has led the NT government, despite its generally supportive attitude towards mining, to extract additional revenues from the industry, bringing it into direct conflict with corporate interests. It is now in dispute with Peko Mines over its attempts to recover additional royalties from previous years' gold production, and is the subject of legal action by NABALCO, a subsidiary of the vertically-integrated Swiss aluminium company, Alusuisse, due to its imposition of an additional tax on the company's bauxite mining and alumina refining operations.[1] In 1981 it introduced a proposal for a profit-based mineral royalty at a rate of 38 percent, bringing it into sharp conflict with mining interests; the royalty rate was subsequently reduced to 18 percent but has continued to draw criticism from the industry, which is currently engaged in a concerted attempt to have it reduced further.

Jabiru also illustrates the complexity of political processes occurring in resource regions. As mentioned above, the extent to whether it develops as a diversified regional centre will depend on political interactions involving mining companies, the NT and federal governments, various Aboriginal groups and agencies concerned with Aboriginal welfare, the tourist and associated service industries, the environmental lobby, and Jabiru's existing residents. It should also be noted that, in the political processes which have determined and will determine Jabiru's development,

"the State" has not consisted of a single entity pursuing one set of interests. In fact, the NT and Commonwealth governments have frequently acted on behalf of diametrically opposed interests and can be expected to do so again in the future; indeed, individual agencies within each government have at times done the same.[2] This fact again indicates the complexity of the political processes involved.

In the case of Tennant Creek and Jabiru, therefore, prospects for survival and long-term growth are not simply a function of company production and investment decisions and of company relationships with local political elites. They are also a function of the available non-mineral resources and of political processes which determine how and to what extent these will be developed and also the extent to which mining company interests are accorded priority over those of other groups.

The case studies also raise a number of important points regarding corporate organization and interests. It is certainly the case that mineral production in the capitalist world is increasingly dominated by multinational corporations which display a high degree of vertical integration and horizontal diversification. However, it is important to recognize that production in a substantial number of resource towns and regions is still under the control of corporations which are not vertically integrated and whose corporate interests are closely tied to the fortunes of a particular deposit or region. Where this is the case, their commitment to a specific community may be considerably higher, and their capacity to shift production and investment considerably lower, than Bradbury and Newton suggest.

Thus while GEMCO and Hamersley are subsidiaries of large corporations with a range of geographically diversified interests, ERA owns only one major mineral deposit, Ranger, and at present plans to invest surplus capital in expanding its operations there rather than in diversification.[3] Peko Wallsend owns a number of mines, but its Tennant Creek operations have represented a major part of its corporate interests and it has over the years invested very substantial sums in discovering a series of new deposits which have permitted maintenance of those operations and also, of course, of employment in the town. The other Tennant Creek company, ADL, has for 30 years obtained almost all its income from its Tennant Creek mines. It has used a significant proportion of this income to fund large-scale exploration aimed at enhancing reserves and allowing milling operations to continue; these programs have recently again yielded some success, averting closure of Noble's Nob.

This last point raises another issue. As mentioned above, Bradbury has suggested that mining corporations can relocate production and investment with relative ease, and that the existence of assets at a par-

ticular mine site is not a significant barrier to their doing so. In my view this approach may seriously underestimate the costs involved in relocation.[4] Because an asset has been written off for tax or accounting purposes does not mean that it is valueless. For example, if Peko can discover a deposit within reasonable distance of Tennant Creek, use of its existing (written down) mill saves it the necessity of expending capital on a new one, and so increases the prospects for capital accumulation. It is also important to realize that a mining company does not simply invest in buildings and machinery. It also invests heavily in developing geological knowledge of a specific region, and in individuals who can employ that knowledge to practical effect. Walking away from a particular resource region can thus involve writing off a very significant investment, and will not be undertaken lightly.

The basic issue here is that all resource corporations do not have identical structures and interests and will not approach production and investment decisions in an identical manner, a fact which can have important implications for particular resource towns or regions. Differences may also exist, for example, in policies on labour recruitment, town administration, and use of mine infrastructure by outsiders. For reasons explained above, these can also affect the prospects for economic diversification.

A final point regards the supposedly exploitative relationship between resource regions and the industrial centre. As mentioned already, both Bradbury and Newton suggest that capital, human and physical resources flow from the resource region to the centre, underdeveloping the former and enriching the latter. However, in my view this concept is more appropriate to, for example, Java or Ireland in the 18th and 19th centuries than it is to remote resource regions of Australia or Canada. Java and Ireland had large populations, highly productive agricultural systems, and substantial indigenous manufacturing sectors. Their people, their land and their industries were exploited by the Dutch through the "culture" system and the British through the "landlord" system, respectively, and the surpluses extracted were indeed large and made a significant contribution towards developing the economies of the colonizers.

On Groote Eylandt or in the Pilbara, for example, the situation is obviously very different. The only resource on Groote, excluding manganese, was land of a type which would only support a scattered population of hunters and gatherers. It was and is of great value to its traditional owners, but of little use to anyone else, and it has hardly been touched by the resource developers; GEMCO's Mineral and Special Purpose Leases cover less than 2 percent of Groote's land area. Likewise in the

Pilbara; driving, for example, from Paraburdoo to Onslow one does not feel, to put it mildly, that this was a land rich in resources available for exploitation. Groote Eylandt and the Pilbara do of course possess minerals, but these only become a resource when capital and labour are applied in converting them to a product which constitutes an input for an industrial process.

In remote resource regions of Australia and Canada, mining corporations commence by bringing in resources. If they failed to do so, it is unlikely in most cases that any significant economic activity would occur, and if anyone doubts this point there are many areas of North Australia, lacking in identified mineral resources, which bear eloquent if mute testimony to its validity. The mining companies which provide capital, the workers who provide skills, the state which provides infrastructure and services, and the commodity producers who provide the physical means of extracting minerals will of course subsequently seek to divide the wealth generated by mineral exploitation between them, and much of it will flow out of the region. If the prospect of it doing so did not exist, none of the parties involved would commit the resources they command in the first place.

To make this point is not to deny that crucial questions do arise regarding the distribution of mineral wealth between owners of the resource (the state) and providers of labour, capital and commodities, and regarding the issue of whether significant opportunities for more broadly-based growth exist in resource regions, once mineral development has provided basic physical and social infrastructure. This last issue is of course the central concern of this study; the empirical evidence presented here indicates that the potential for more broadly-based growth depends crucially on the location of individual mining projects and the particular resource endowment of the region in which they are located. The degree to which that potential is realized depends to an important extent on the corporate structures of individual project developers and on the policies pursued by developers and by governments.

NOTES

1. Personal communication, Peko Mines; "Three Way Attack on NABALCO", Midweek Territorian, 18 December 1985.

2. Lea and Zehner, Yellowcake and Crocodiles.

3. ERA, Annual Report, 1985.

4. In a recent article, John Bradbury has recognized that the mobility of capital in the mining sector is in fact relatively low: "International Movements and Crises in Resource Oriented Companies: the Case of Inco in the Nickel Sector", Economic Geography, vol. 61, no. 2, April 1985, p. 130.

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